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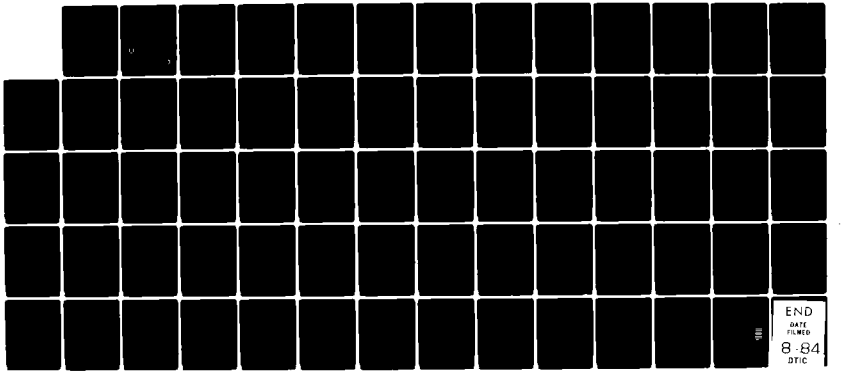

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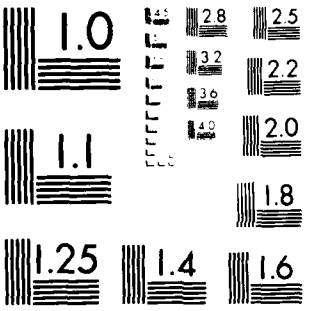

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CONTRACT REPORT ARBRL-CR-00529

# AERODYNAMIC HEATING COMPUTATIONS FOR PROJECTILES - VOL. III: BRL INTERACTIVE PLOTTING PROGRAM (BRLINPLOT)

Prepared by
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June 1984

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT CENTER
BALLISTIC RESEARCH LABORATORY
ABERDEEN PROVING GROUND, MARYLAND

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This work was performed under the direction of the Aerodynamics Research Branch, Launch and Flight Division, DRSMC-BLL (A), Dr. Walter B. Sturek, Contracting Officer's Technical Representative.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Interactive Computing
Grid Generation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the development of an interactive plotting and grid generation program for generating input data for the ABRES Shape Change Code. The program as developed can provide grid input data for ASCC80 as well as the modified codes BRLASCC and PLNRASCC. The report contains test cases and a detailed user's guide which describes the input data required to run the code.

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TABLE OF CONTENTS

# SECTION 1

# INTRODUCTION

This report documents the BRL Interactive Plotting Program developed under the Aerodynamic Heating Computations for Projectiles program. The overall objectives of this program were threefold:

- Modify the in-depth heat conduction package to improve ASCC's capabilities to handle slender multimaterial configurations
- Extend the developments of planar ASCC modifications to predict heating of swept fin configurations to include: (a) turbulent flow on swept wings; (b) 2-D shock shape; and (c) improved in-depth heat conduction routines
- Develop an interactive computational grid developing routine to simplify the procedure for inputting body configurations and developing computational grids for ASCC

The BRLINPLOT program is described in Volume III of this report. Changes made to ASCC80 covering Objectives 1 and 2 are documented in Volumes I and II, respectively. In this document, the updated ASC Code is referred to as BRLASCC.

It has frequently been difficult to set up the internal heat conduction grids and material interfaces required in the ASC code. It often required meticulous hand plotting by the user and then several iterations with the ASC code to set up appropriate implicit and explicit grids. Therefore the purpose

of the BRLINPLOT computer program is to allow the user to iterate on the geometry interactively without running BRLASCC. Utilizing BRLINPLOT, the user can view, correct, and review the implicit and explicit grid configurations and considerably reduce the chance of user input error. Once the conduction grids are satisfactory, BRLINPLOT creates an output file of Input Table 3 to be used with BRLASCC. The user can insert this file from BRLINPLOT directly into the BRLASCC input file.

Section 2 of this report describes how to use the BRLINPLOT program. Included in the section are: (1) device definitions that must be made prior to running the program; (2) instructions for the input file; (3) a list of definitions of the interactive commands used once the user has started running the program; and (4) a sample problem illustrating the input file, the terminal session, and the resulting BRLASCC Input Table 3 file.

# SECTION 2

# INPUT AND OUTPUT

This section is devoted to a user-oriented discussion of input and output for the BRL-Interactive Plotting Program (BRLINPLOT). Section 2.1 describes the device definitions required, Section 2.2 includes a complete set of input instructions, Section 2.3 outlines the interactive commands used when running the program, and Section 2.4 presents a sample problem to demonstrate the program.

## 2.1 DEVICE DEFINITIONS

The following device definitions must be made prior to running the BRLINPLOT Code:

- File 4 (FOR004) = Data input file
- File 7 (FOR007) = New data file generated by BRLINPLOT
- File 8 (FOR008) = Output file

An additional file will be defined interactively for output of a device independent plot file if desired by the user.

## 2.2 INPUT INSTRUCTIONS

The input to the code consists of:

- Three title cards
- One flag card
- Input Table 3 from BRLASCC (in its entirety)

The following sections describe these three input tables.

### 2.2.1 Title Cards

The first three cards of the input file contain title information in Columns 1 through 72. The first line will be included in the new output data file (FOR007) for reference purposes.

### 2.2.2 Flag Card

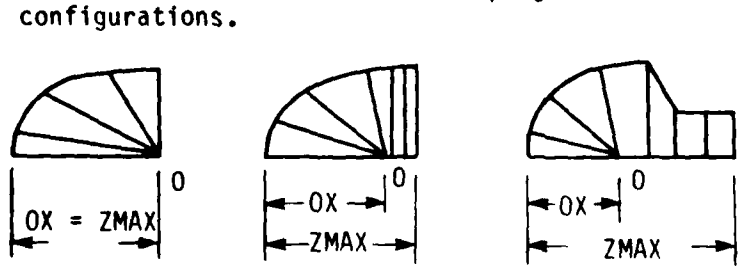
This card supplies the code with program flags which indicate options to be used.

| COLUMNS | FORMAT | FLAG | DEFINITION |
|---|---|---|---|
| 1-5 | I5 | LG | Environment Flag<br>-1 -- Flight with internally calculated trajectory<br>+1 -- Any other environment (flight, wind tunnel, ballistic range, general, arc heater) |
| 6-10 | I5 | ISS | Shape Change Flag<br>0 -- Shape change with transient in-depth conduction<br>1 -- Shape change with steady-state in-depth conduction<br>2 -- No shape change |
| 11-15 | I5 | IPLOTR | Device independent plot file flag<br>0 -- Plots will appear on terminal screen<br>1 -- Plots will not appear on screen but will instead be output to a file for use with a printer (the file name is defined interactively by the user) |

### 2.2.3 Input Table 3. Initial Configuration and In-Depth Conduction Grid Parameters

| | | | | |
|---|---|---|---|---|
| 1 | 1- 2 | I2 | Enter 03 (table number) | -- |
| 2 | 1- 5 | I5 | NS -- Number of points on the heated surface of the body (maximum 50 points)<br>>0 -- Sphere-cone shape option (applicable only for single material bodies)<br><0 -- General shape option | -- |

| Card No. | Columns | Format | Data | Units |
|---|---|---|---|---|
| | 6-10 | I5 | NPN -- Number of points on the nose; applicable only to sphere-cone option (NS > 0) | -- |
| | 11-15 | I5 | MAT -- Material index for single material nosetip. If the nosetip is multimaterial (maximum of six in-depth materials, general shape option only) it may be entered as zero. | -- |
| 3 | 1- 2 | | Blank | |
| | 3-14 | E12.5 | RNI -- Initial nose radius† | Inch |
| | 15-26 | E12.5 | ZMAX -- Maximum axial length (required input for sphere-cone option only)<br>ZMAX = Z-coordinate of the last point on the sphere-cone | Inch |
| | 27-38 | E12.5 | THETA -- Initial cone half angle (required input for sphere-cone option only) | Deg |
| | 39-50 | E12.5 | OX -- Axial position of the origin of the rays<br><0 -- Flat back option<br>>0 -- Plug option | Inch |
| 3 | | | The following sketches illustrate the nosetip configuration/location of the origin of the ray's combination which are referred to as flat back or plug configurations. | |




a. Flat back (OX = ZMAX) b. Plug (OX < ZMAX)

†Used to estimate transition altitude (or time), and for scaling of body input information

| Card No. | Columns | Format | Data | Units |
|---|---|---|---|---|
| | 51-62 | E12.5 | TS -- Initial body temperature. This input will be overridden if surface temperature distribution is input via Table 07. | °R |
| | 63-74 | E12.5 | STRD -- (Transient option only, ISS = 0.) Maximum surface temperature rise desired between time steps. If it is less than 49°R or greater than 201°R, it is set to 75°R. | °R |

- - - - - - - - - - - - - - - - General Shape Option - - - - - - - - - - - - - - - -

The generalized shape/interface option can be thought of as describing the boundary lines for each material in the vehicle. Each material interface should be described as a closed loop (i.e., one point should be specified twice). A simple sample will best illustrate the use of the new option. Consider a vehicle modeled by the following geometry:

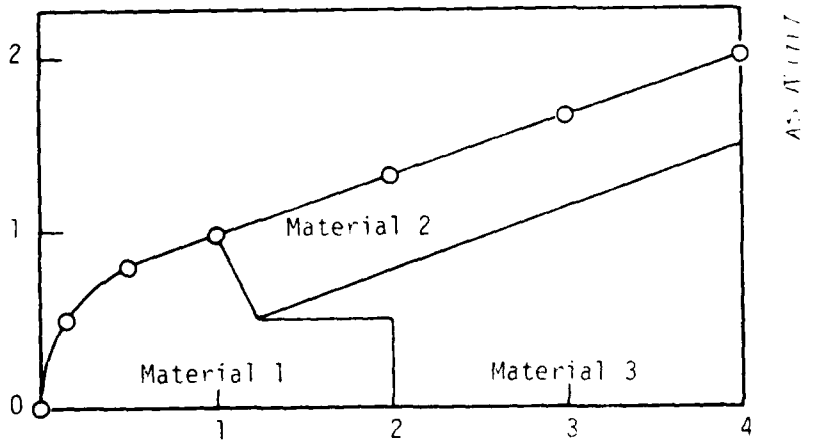



Table 3 input for this geometry is shown in Figure 1 with 10 surface points, models the interface with 22 input points, and has 1 plug point. Although the configuration appears as a flat back, the user has specified a plug option (Figure b, Page 3-14) so that the origin of rays may be placed

closer to the nosetip for better implicit layer definition. As such, the user must specify the flat back face as an unheated surface. From this data, the code will calculate the coordinates and material flags of the interface intersections with ray within the implicit layer, and the material flag indices for the explicit grid, NMAT.

| Card No. | Columns | Format | Data | Units |
|---|---|---|---|---|
| 4 | 1-20 | F10.3,F8.3,I2 | ZSP(I), RSP(I), NB1(I) -- For I = 1, NS. Body point coordinates and material indices for the surface of the vehicle.<br><br>Enter one surface point per card. Enter as many cards as there are surface points (NS). | Inch |
| 5 | 1- 5 | I5 | NIF -- Number of points used to describe the interfaces | -- |
| 6 | 1-20 | F10.3,F8.3,I2 | ZIS(I), RIS(I), NBS(I) -- For I = 1, NIF. Coordinates and material indices for the interface locations.<br><br>Enter one interface point per card. Enter as many cards as there are interface points (NIF). | Inch |

If the geometry consists of only one material, the interface boundary is described first by tracing the surface body points then closing the loop.

- - - - - - - - - - - - - - - - Plug option only - - - - - - - - - - - - - - - -

(Read only if OX > 0)

Plug points identify the remaining surface points that are not on the heated surface. Note if a flat back configuration is specified as a plug (Figure b, page 3-14), that is OX > 0, then a single plug point is required, connecting the last surface point to the axis, which describes the unheated flat back face.

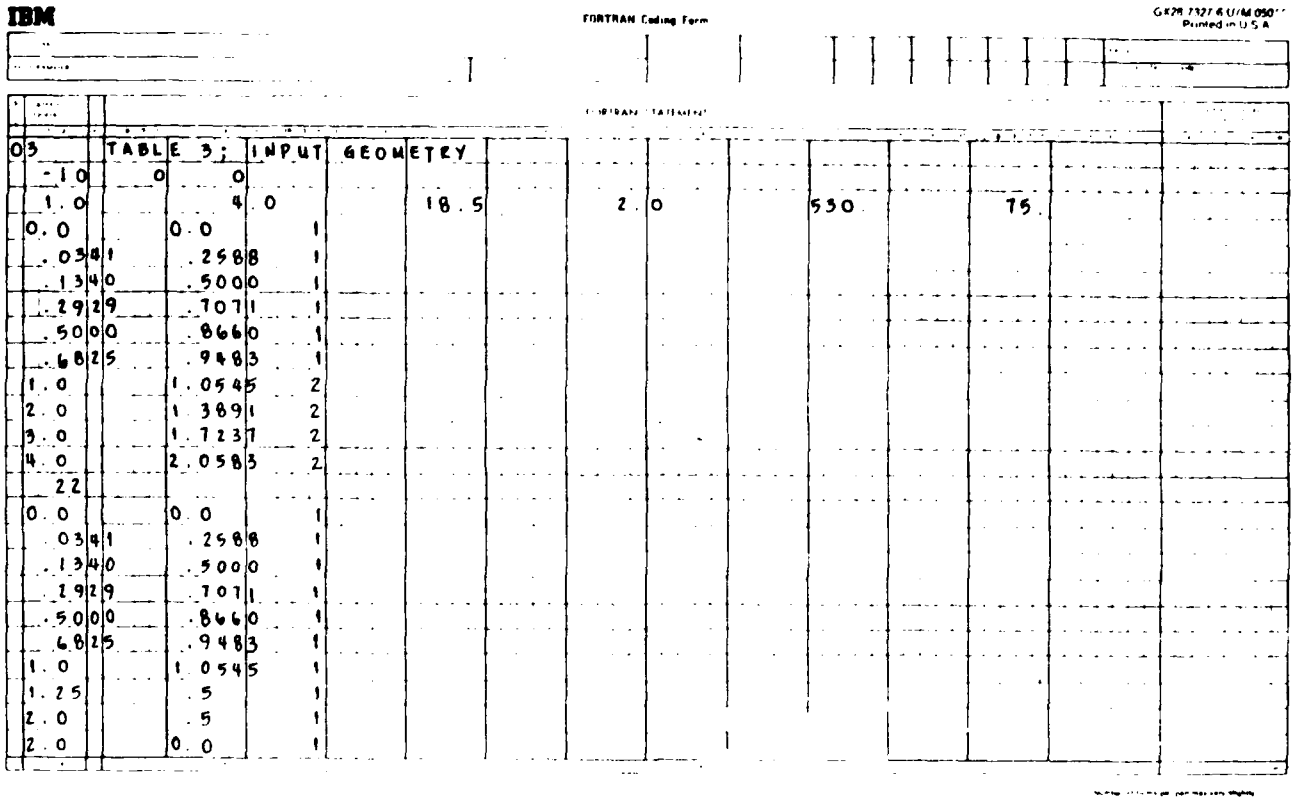



Figure 1. Sample Table 3 Input for General Shape/Interface Option

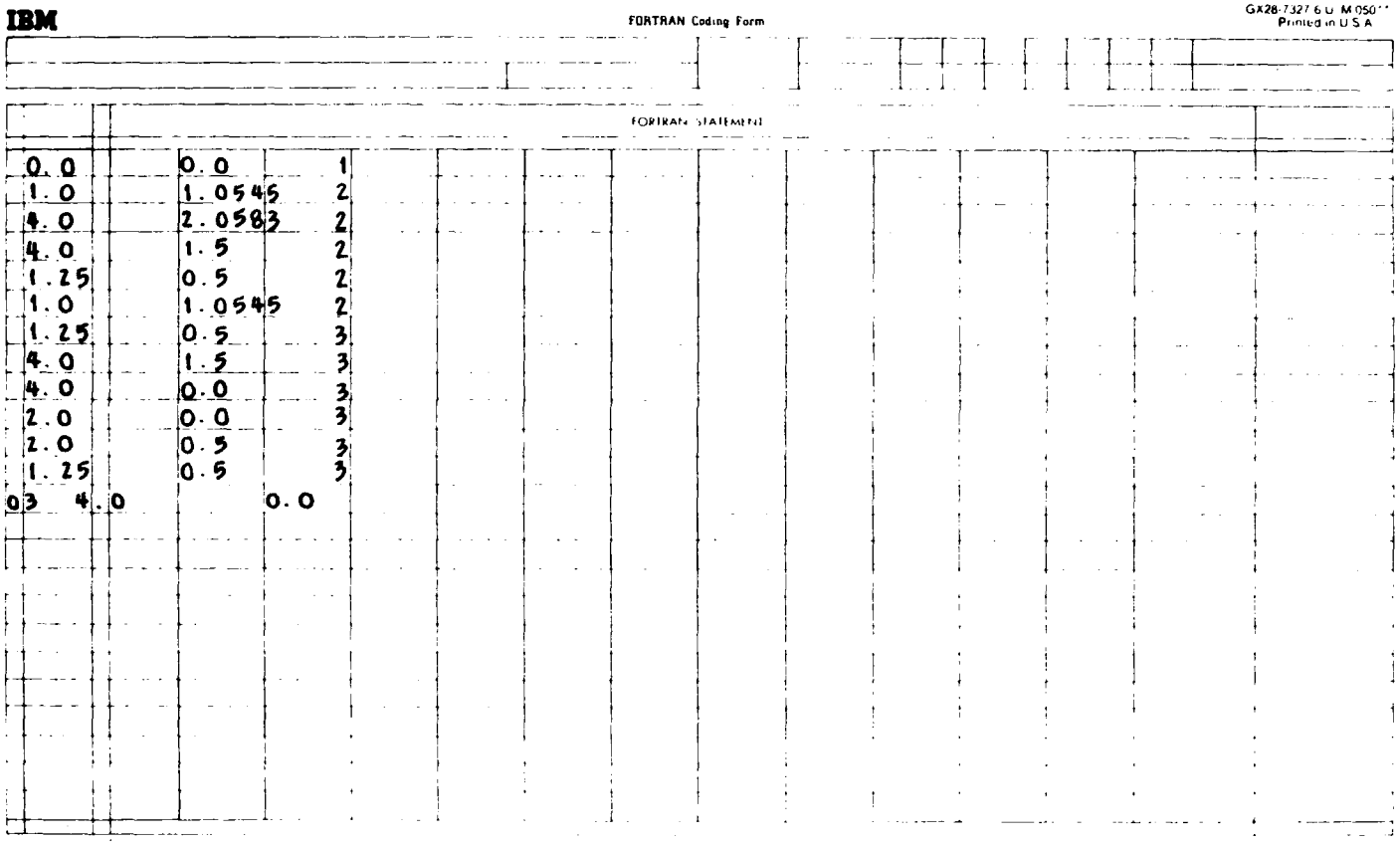


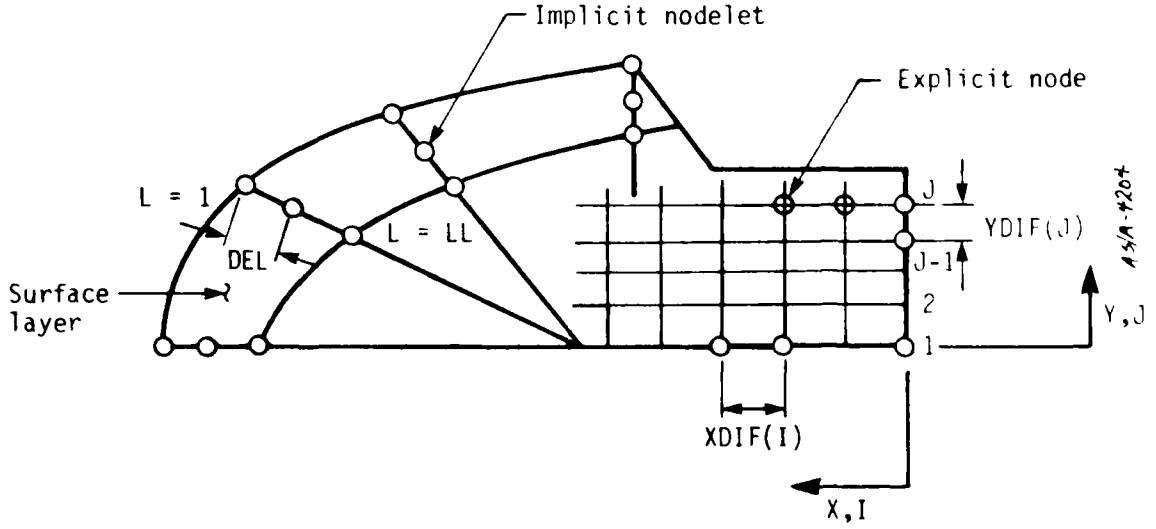

Figure 1. (Concluded)

| Card No. | Columns | Format | Data | Units |
|---|---|---|---|---|
| 5 | 1- 2 | I2 | NC -- Flag to read the coordinates of the body points | -- |
| | | | = 0 -- Keep reading | |
| | | | ≠ 0 -- Stop reading. This indicates that the card is the last of its kind. | |
| | 3-14 | E12.5 | ZSP -- Body point axial length, (z) | Inch |
| | 15-26 | E12.5 | RSP -- Body point radial length, (r) | Inch |

- - - - - - - - - - - - - - - - In-depth grid setup - - - - - - - - - - - - - - - -

(Transient option only: ISS = 0)

This in-depth grid definition and nomenclature are shown in the following sketch.




Comments on the Choice of the In-Depth Grid

The grid size and distribution are problem dependent. In general, there is no rule as to what the optimum value of the grid size is and one has to perform some numerical experiments to arrive at the optimum value. The acceptable solution to the problem is the one which does not change when the grid size is further refined.

In order to obtain a rough estimate of the thickness of the surface layer, we use the results of steady-state analysis of a semi-infinite solid with constant surface temperature (or heat flux) and recession rate, $\dot{s}$. It can be shown that the thermal penetration depth in the solid is

$$D_p = \frac{2.3\alpha}{\dot{s}}$$

where $\alpha$ is the material thermal diffusivity and $D_p$ is defined to be the distance from the receding surface to where the temperature drops to 10 percent of the surface temperature.

In the nosetip application, if we can estimate a characteristic recession rate, $\dot{s}$, we may state that the surface layer thickness should be greater than or at least equal to $D_p$ obtained from the above formula.

For plug configuration the position of the origin of the rays on the axis of symmetry is input by the user. As a guide to determine the position of this origin, it should be noted that for accuracy of computations we desire the rays to be as close to the surface normals as possible. On the other hand, the distance OX should be large enough to allow the surface to recede without getting too close to the origin of the rays. The computations are set to stop if the distance from the back of the surface layer to the origin of the rays is anywhere smaller than DSMOVE unless the automatic shifting option is specified. In the former case, the computations can be continued by relocating the origin of the rays and using the code restart capability. The input format for the in-depth grid is as follows:

## Implicit Grid

| Card No. | Columns | Format | Data | Units |
|---|---|---|---|---|
| 6 | 1- 5 | I2 | LL -- Total number of implicit nodes (nodlets) along each ray (maximum 15) | -- |
| 7 | 1- 2 | I2 | Blank | |
| | 3-74 | 6E12.5 | DELN(I) -- For I=2, LL; normalized nodlet spacing (normalized distance between nodlets, from surface inwards must sum to unity; maximum of 14). If uniform spacing is desired, enter only one spacing, DELN(2); i.e., 1/(LL-1) = uniform spacing. | -- |
| 8 | 1- 2 | I2 | Blank | |
| | 3-74 | 6E12.5 | DEL(I) -- For I=1, NS; surface layer thickness along each ray. If uniform thickness is desired, enter only one thickness, DEL(1) | Inch |
| 9 | 1- 5 | I5 | IL -- Number of explicit nodes in the X-direction (maximum 60) | -- |
| | 6-10 | I5 | JL -- Number of explicit nodes in the Y-direction (maximum 25) | -- |
| 10 | 1- 2 | | Blank | |
| | 3-74 | 6E12.5 | XDIF(I) -- For I = 2, IL (six to a card), X-direction distance between grid nodes. For uniform grid spacing in both X and Y directions enter one value only, XDIF(2) | Inch |
| 11 | 1- 2 | | Blank | |
| | 3-74 | 6E12.5 | YDIF(J) -- For J = 2, JL (six to a card), Y-direction distance between grid nodes | Inch |

Not input for uniform grid spacing

- - - - - - - - - - - - Trajectory calculation option only - - - - - - - - - - -

(Read only if LG = -1)

| Card No. | Columns | Format | Data | Units |
|---|---|---|---|---|
| *12 | 3-14 | E12.5 | THETAC -- Frustum angle to be used in calculating the aft body drag | Deg |

| Card No. | Columns | Format | Data | Units |
|---|---|---|---|---|
| | 15-26 | E12.5 | RBAS -- Vehicle base radius | Inch |
| | 27-38 | E12.5 | VLN -- Vehicle axial length | Inch |
| | 39-50 | E12.5 | XCG -- Vehicle center of gravity location from stagnation point | Inch |
| | 51-62 | E12.5 | WT -- Vehicle weight | lbm |

## 2.3 INTERACTIVE COMMANDS

This section defines the various commands available in the BRLINPLOT program. The definitions shown below can be acquired by using the "HELP" command.

Commands available (Note: Commands must be input in capital letters):

| | | | | | |
|---|---|---|---|---|---|
| PSUR | PIMP | PEXP | PINT | PALL | MSUR |
| MIMP | MEXP | MINT | ZOOM | HELP | SAVE |
| UPDT | NOPR | PRMT | HALT | | |

Modification options available:

S P R C I D

Command PSUR:
Plots the surface points

Command PIMP:
Plots the implicit grid

Command PEXP:
Plots the explicit grid nodes and shows which nodes lie in the implicit grid

Command PINT:
Plots the interface points which were input using the general interface option

Command PIMP:
Plots the implicit grid

Command PALL:
Plots the explicit grid nodes, the material interface points, and the upper and lower bounds of the implicit grid

Command MSUR:
Displays and modifies variables associated with the surface points

WARNING

Variables in this routine may be affected by changes in the implicit grid.

Command MIMP:
Displays and modifies variables associated with the implicit grid

WARNING

Variables in this routine may be affected by changes in the surface points.

Command MEXP:
Displays and modifies variables associated with the explicit grid

Command MINT:
Displays and modifies variables associated with the general interface option

Command ZOOM:
Rescales the window for better resolution. The routine will prompt for the new window coordinates. User must enter all four parameters (inches)

Command HELP:
Provides a short list of commands/options and allows the user to access information concerning the use of these commands

Command SAVE:
Punches and prints the modified input data

Command UPDT:
Updates the variables used by the plotting routines using any modifications to the data

Command NOPR:
Turns off the command prompting

Command PRMT:
Turns on the command prompting

Command HALT:
Halts execution of the code

Option S => SHOW:
Displays the variables associated with the current modification routine

Option P => PLOT:
Updates and plots the changes made in the current modification routine

Option R => RETURN:
Returns to the control program

Option C => CHANGE:
Changes the specified variable

```
Syntax:  C VAR LOC VALUE
where:   C     => CHANGE option
         VAR   => Variable to the modified
         LOC   => The array index to be modified for nonarray
                  variables (enter 1 for nonarray variables)
         VALUE => The new value to be stored in VAR(LOC)
```

Option I => INSERT:
Inserts values into the specified array

```
Syntax:  I VAR LOC
where:   I   => INSERT Option
         VAR => Variable to be modified. In the surface and
                general interface routines, "all" may be
                entered to insert values in all arrays
         LOC => The location in VAR after which
                the insertion will be made
```

The modification routines will prompt for the values to be inserted. If "ALL" is specified as VAR, the variables which reflect the number of entries in the arrays will also be modified.

Enter "Q" to quit inserting new values.

Option D => DELETE:
Deletes values in the specified array

```
Syntax:  D VAR ISRT ISTOP
where:   D     => DELETE option
         VAR   => Variable to be modified. In the
                  surface and general interface
                  routines, "ALL" may be entered to
                  delete values in all arrays.
```

ISRT => The first array index in VAR
to be deleted.
ISTOP => The last array index in VAR
to be deleted.

If "ALL" is specified as VAR, the variables which reflect the number of entries in the arrays will also be modified.

## 2.4 SAMPLE PROBLEM

This section demonstrates the versatility of the BRLINPLOT program. A sample nosetip geometry is input, modified, and a new geometry table is produced. First, a listing of the input data is shown in subsection 2.4.1, then a "photo" of the complete terminal session is in subsection 2.4.2, and finally, a listing of the new geometry table, ready for inclusion in the BRLASCC input file is shown in subsection 2.4.3.

## 2.4.1 Input File Listing

```
BRL FLIGHT CASE
TRANSIENT CONDUCTION SOLUTION -- BRLASCC
12.5 DEG NOSE, 8 INCH BODY
1    0
03
 -12              1
  0.06                                  2.2        585.        200.
  0.0    0.0      1
   .001   .0605   1
   .20    .105    1
   .45    .1603   1
   .7     .2157   1
  1.00    .2822   1
  1.249   .3375   1
  1.55    .3798   1
  1.9     .429    2
  2.2     .4712   2
  5.1     .8788   2
  8.0    1.2863   2
 32
  0.0    0.0      1
   .001   .0605   1
   .20    .105    1
   .45    .1603   1
   .7     .2157   1
  1.00    .2822   1
  1.249   .3375   1
  1.55    .3798   1
  1.875   .425    1
  1.94    .32     1
  1.76    .291    1
  1.76    .226    1
  1.268   .1571   1
  1.268   .0775   1
  0.86    .0775   1
  0.86   0.0      1
  0.86    .0      2
  0.86    .0775   2
  1.76    .0775   2
  1.76    .291    2
  1.94    .32     2
  1.875   .425    2
  2.2     .4712   2
  5.1     .8788   2
  8.0    1.2863   2
  8.0    0.0      2
  0.86   0.0      2
  1.268   .0775   3
  1.268   .1571   3
  1.76    .2157   3
  1.76    .0775   3
  1.268   .0775   3
03 8.0             0.0
  6   12
  .2
  .3
 44   10
 0.20
```

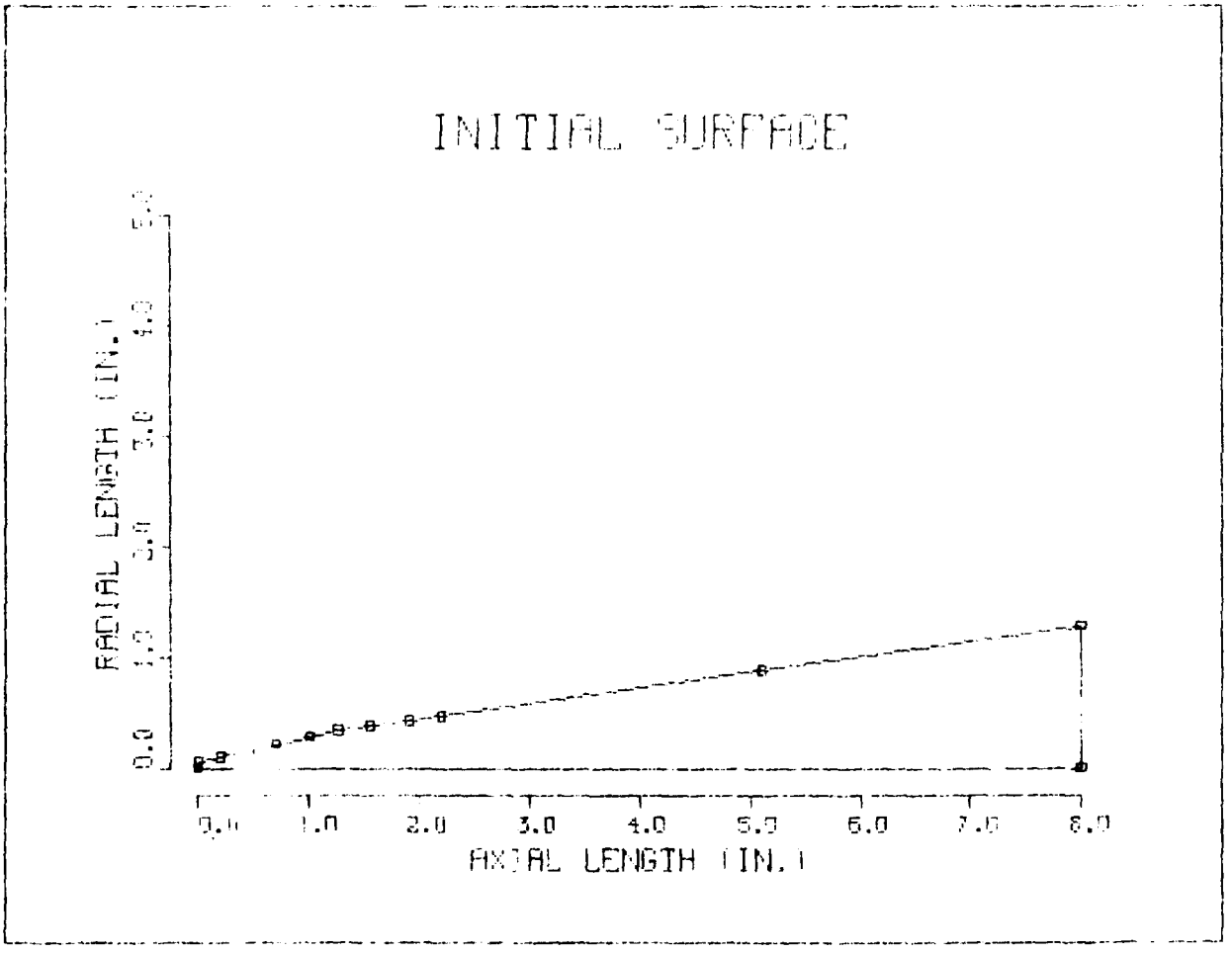
### 2.4.2 Terminal Session

The following subsections illustrate the actions of the BRLINPLOT user at the terminal. First, after the input/output files were defined, the program was initiated. Subsection 2.4.2.1 shows the use of the various plot commands, and subsections 2.4.2.2 through 2.4.5 illustrate the different modification techniques.

#### 2.4.2.1 Using the Plot Commands

The PSUR, PIMP, PEXP, PINT, PALL, and ZOOM commands are demonstrated herein. Notice that the program will only work when the commands are capitalized and spelled correctly.

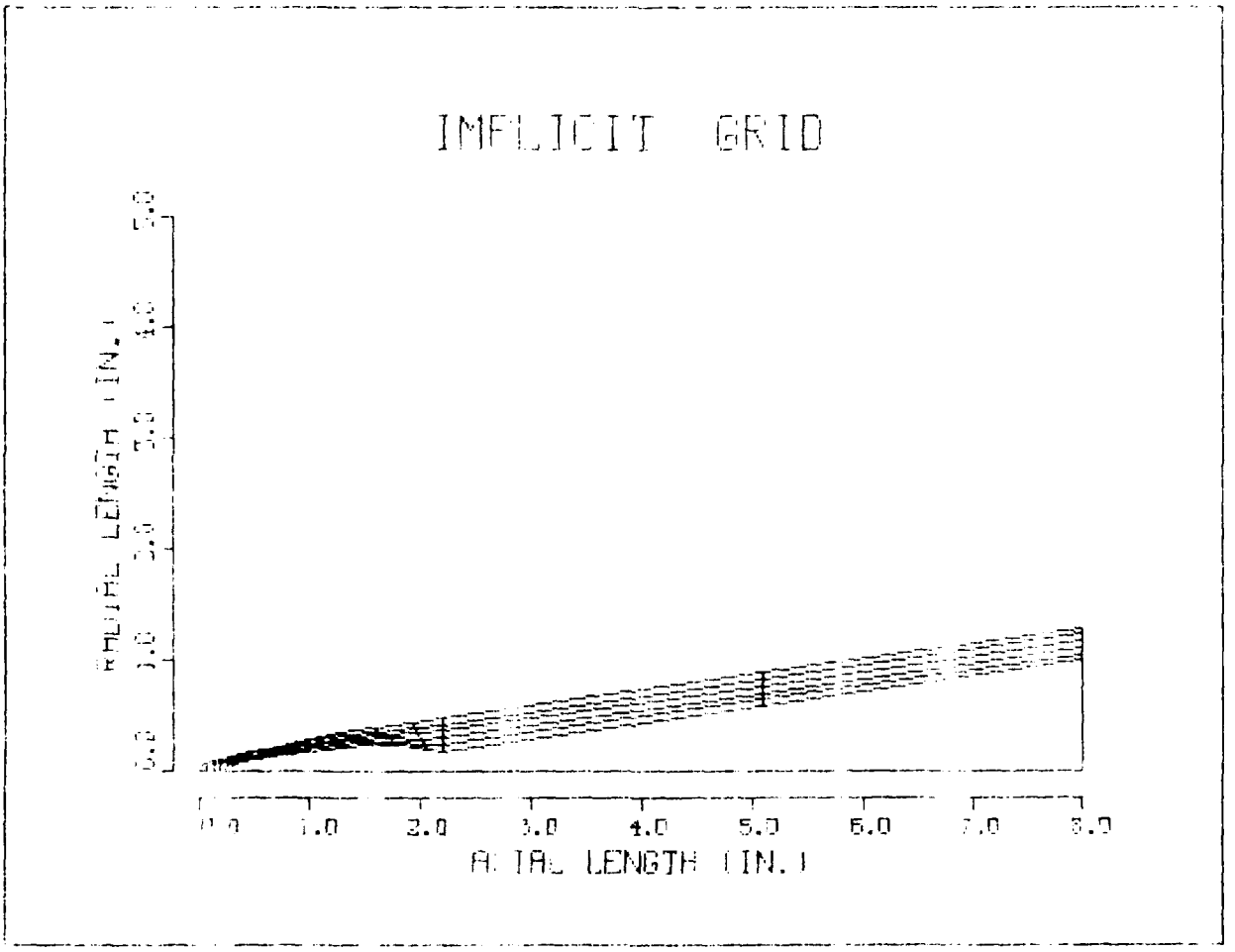
```
$ ASS BRLGEOM.DAT FOR004
$ ASS BRLGEOM.OUT FOR008
$ ASS NEWGEOM.PCH FOR007
$ RUN BRLINPLOT
     INPUT DATA HAS BEEN READ AND ALL VARIABLES ARE DEFINED

              PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
          PLOT COMMANDS:      PSUR  PIMP  PEXP  PINP  PALL  ZOOM
          MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
          GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
PUSR
INVALID COMMAND:  PUSR
COMMAND
PSUR
```



PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

| | | | | | | |
|---|---|---|---|---|---|---|
| PLOT COMMANDS: | PSUR | PIMP | PEXP | PINT | PALL | ZOOM |
| MODIFY COMMANDS: | MSUR | MIMP | MEXP | MINT | | |
| GENERAL COMMANDS: | HELP | SAVE | UPDT | NOPR | PRMT | HALT |

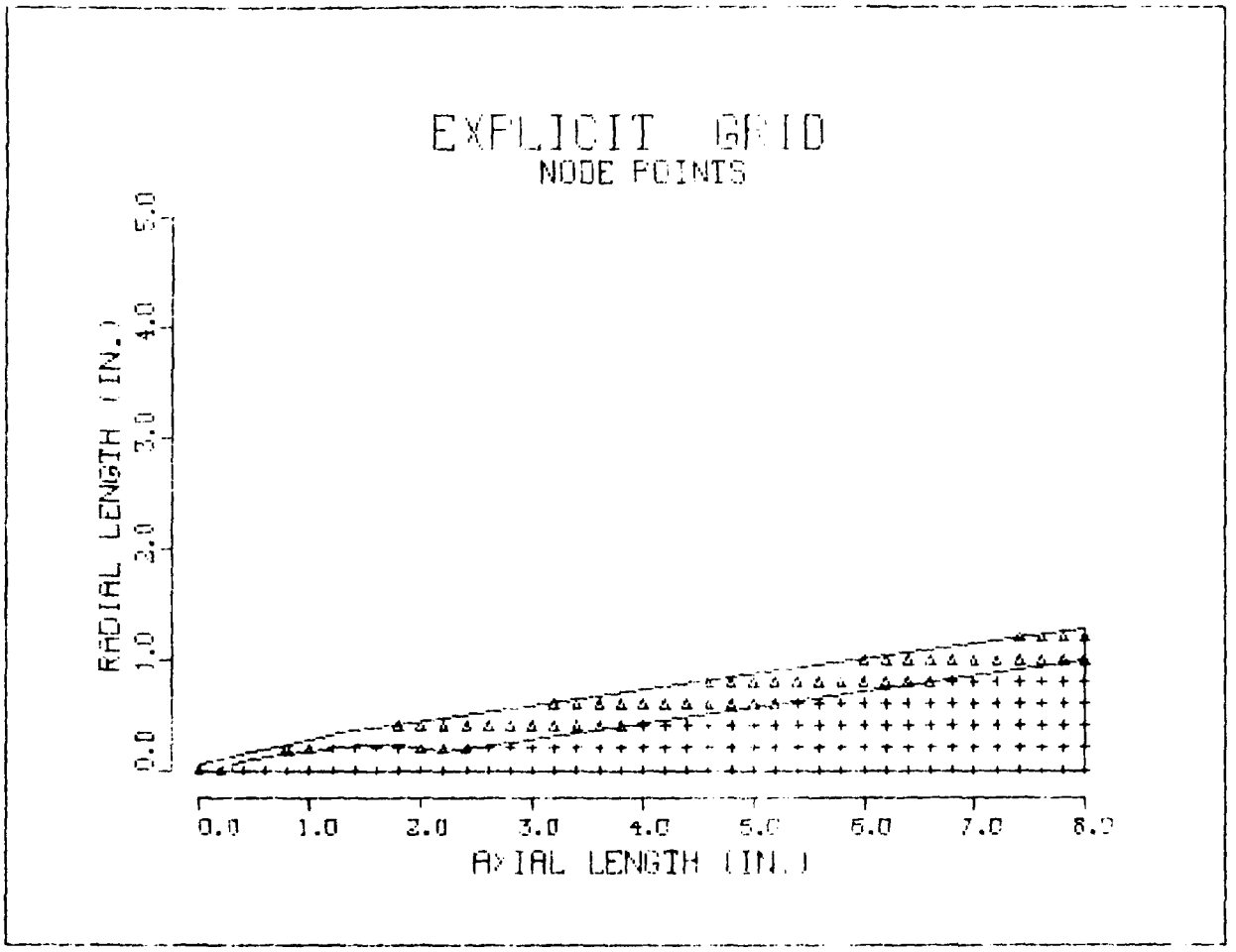
COMMAND
PIMP



PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

| | | | | | | |
|---|---|---|---|---|---|---|
| PLOT COMMANDS: | PSUR | PIMP | PEXP | PINT | PALL | ZOOM |
| MODIFY COMMANDS: | MSUR | MIMP | MEXP | MINT | | |
| GENERAL COMMANDS: | HELP | SAVE | UPDT | NOPR | PRMT | HALT |

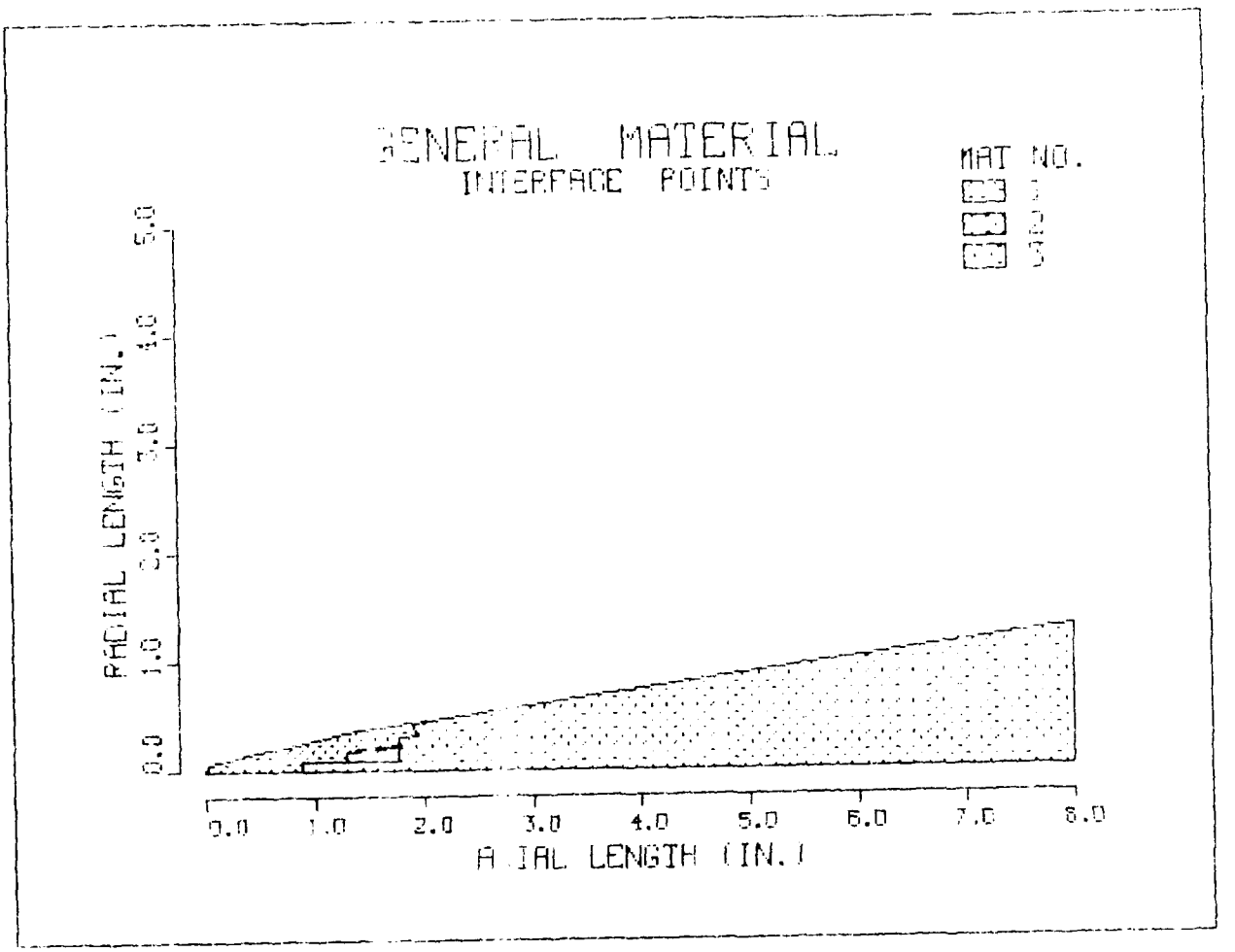
COMMAND
PEXP



PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

| | | | | | | |
|---|---|---|---|---|---|---|
| PLOT COMMANDS: | PSUR | PIMP | PEXP | PINT | PALL | ZOOM |
| MODIFY COMMANDS: | MSUR | MIMP | MEXP | MINT | | |
| GENERAL COMMANDS: | HELP | SAVE | UPDT | NOPR | PRMT | HALT |

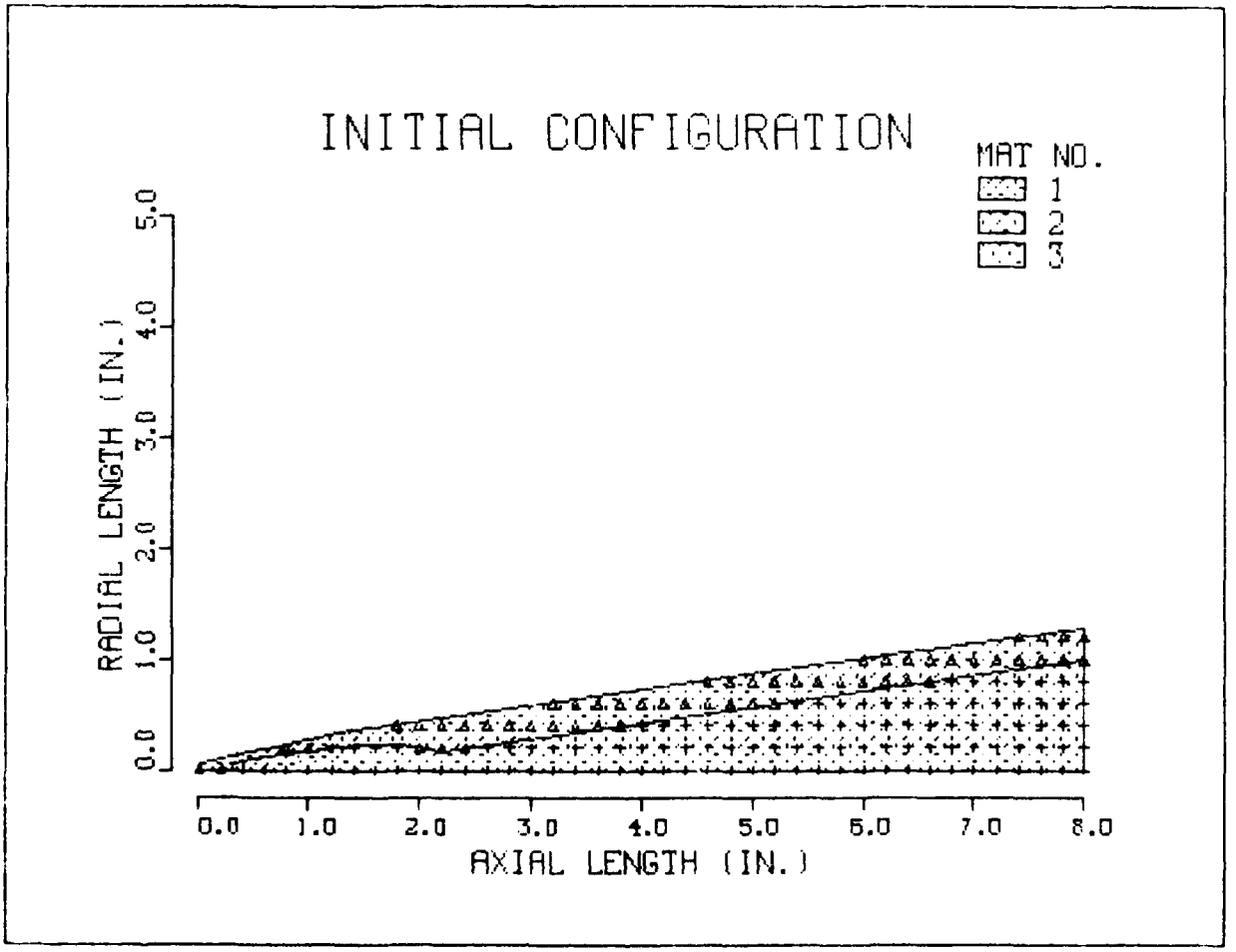
COMMAND
PINT



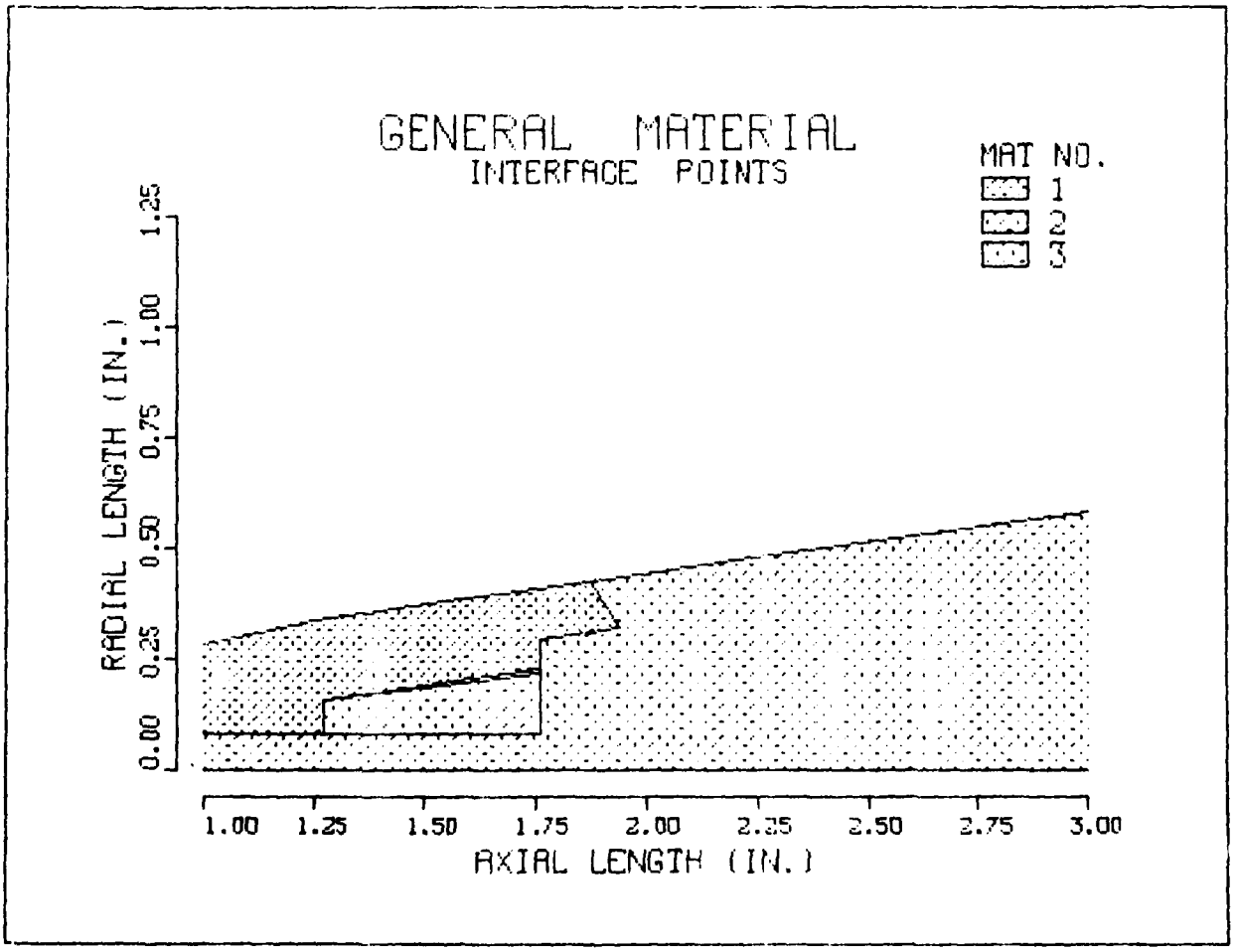
PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

| | | | | | | |
|---|---|---|---|---|---|---|
| PLOT COMMANDS: | PSUR | PIMP | PEXP | PINT | PALL | ZOOM |
| MODIFY COMMANDS: | MSUR | MIMP | MEXP | MINT | | |
| GENERAL COMMANDS: | HELP | SAVE | UPDT | NOPR | PRMT | HALT |

COMMAND
PALL



```
            PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
ZOOM
CURRENT WINDOW COORDINATES ARE:
ZLEFT= 0.00 ZRITE= 8.00 RBOT= 0.00 RTOP= 2.66

ENTER NEW COORDINATES
1.0 3.0 0.0 1.0

            PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
PINT
```



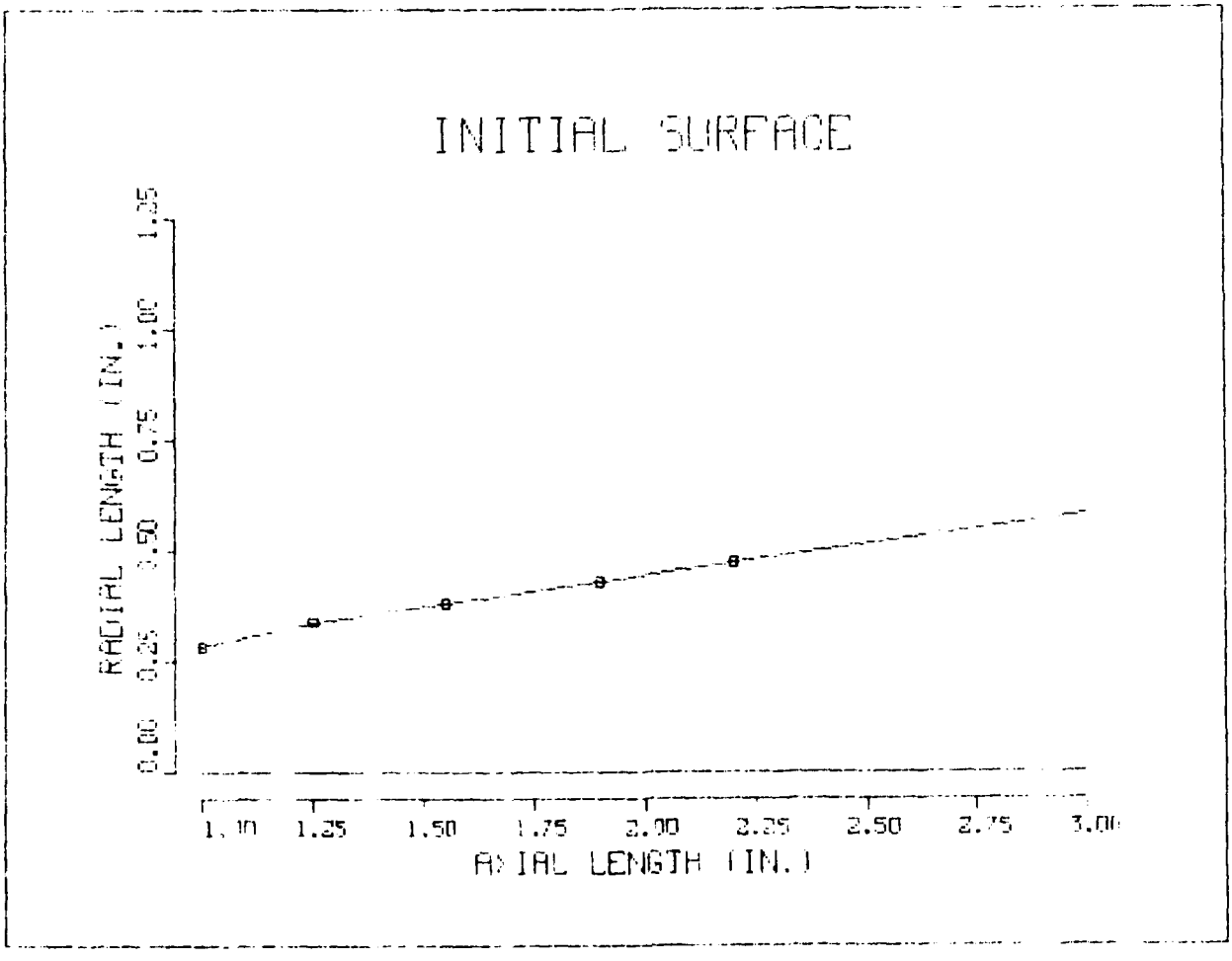
2.4.2.2 Modifying the Surface Shape

The various modify commands Show, Plot, Change, Insert, Delete, and Return are shown next. The MSUR command was used to get into the modification level. The original body shape input was listed using S, and then plotted (in the ZOOMed coordinate system) using P. Next, C, was used to change the location of point 8 and the new shape was plotted. An additional point was added after point 8 and this shape was listed and plotted. Finally point 8 was deleted with the resulting shape listed and plotted.

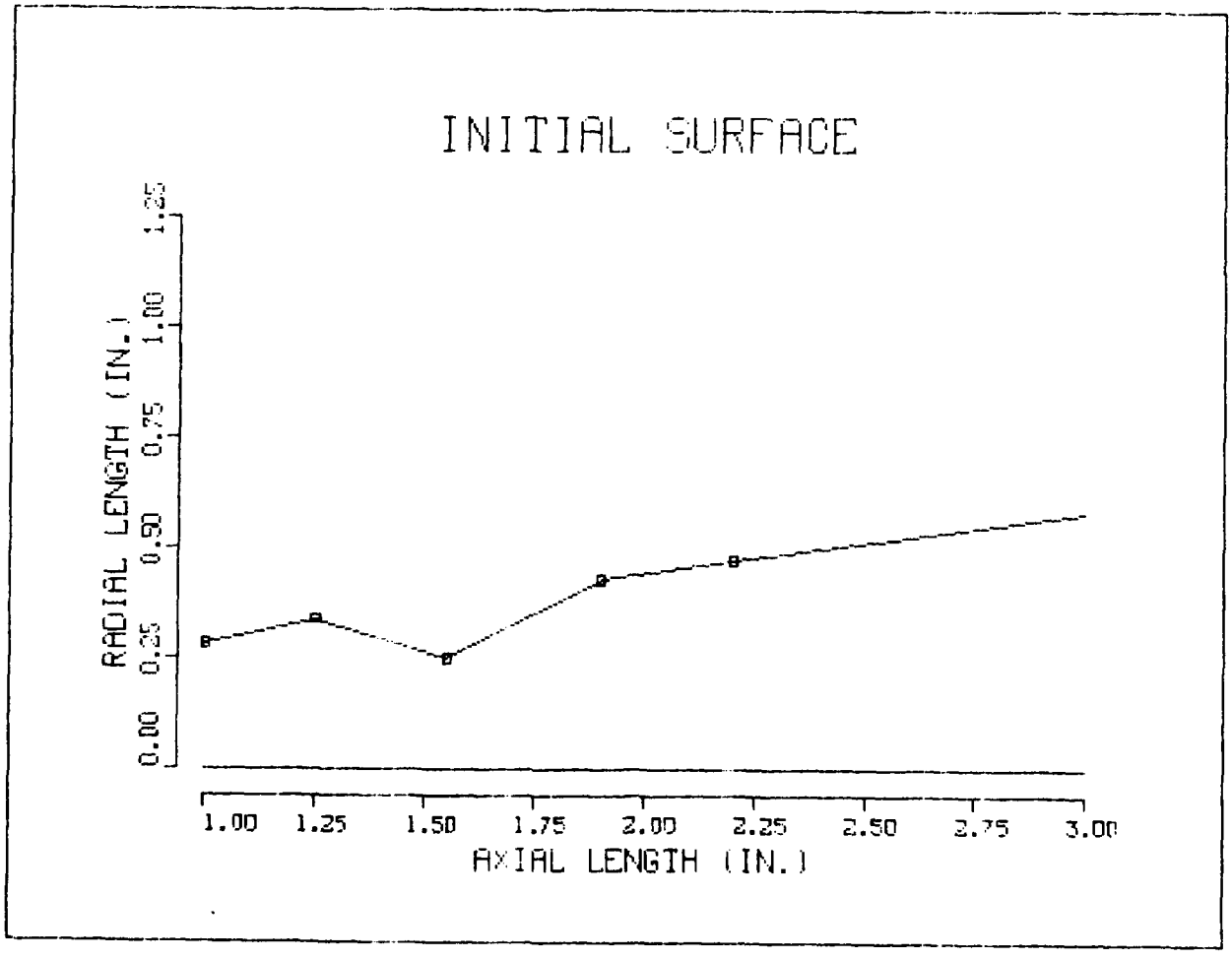
The user then returned to the command level using R, and changed the "window" of the plot using ZOOM.

```
          PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
        PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
        MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
        GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
MSUR

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
S
CONTROL VARIABLES:  ISS = 0   0 => TRANSIENT CONDUCTION
                              1 => STEADY STATE COND.
                              2 => BOUNDARY LAYER
                    INOPT = 1 0 => ASCC77 INTERFACE FORMAT
                              1 => ASCC80 INTERFACE FORMAT
INTEGER VARIABLES:  KLF =14   NO. OF POINTS INCLUDING PLUG
                     NS =-12  NO. OF SURFACE POINTS
                    NPN = 0   NO. OF POINTS ON NOSETIP
                    MAT = 0   MATERIAL NUMBER
REAL VARIABLES:  RNI = 0.06 INITIAL NOSE RADIUS
                THETA = 0.00 INITIAL CONE HALF ANGLE
                 ZMAX = 0.00 MAX. VEHICLE LENGTH
                 STRD =200.0 MAX. TEMPERATURE RISE
                   TS = 585. INITIAL SURFACE TEMP.
GENERALIZED GEOMETRY WITH GENERALIZED INTERFACE FORMAT

SURFACE POINTS:

N    RSP      ZSP    NB1   RI1      ZI1    NB2   RI2      ZI2    NB3
 1   0.0000   0.0000  1    0.0000   0.0000  0    0.0000   0.0000  0
 2   0.0605   0.0010  1    0.0000   0.0000  0    0.0000   0.0000  0
 3   0.1050   0.2000  1    0.0000   0.0000  0    0.0000   0.0000  0
 4   0.1603   0.4500  1    0.0000   0.0000  0    0.0000   0.0000  0
 5   0.2157   0.7000  1    0.0000   0.0000  0    0.0000   0.0000  0
 6   0.2822   1.0000  1    0.0000   0.0000  0    0.0000   0.0000  0
 7   0.3375   1.2490  1    0.0000   0.0000  0    0.0000   0.0000  0
 8   0.3798   1.5500  1    0.0000   0.0000  0    0.0000   0.0000  0
 9   0.4290   1.9000  2    0.0000   0.0000  0    0.0000   0.0000  0
10   0.4712   2.2000  2    0.0000   0.0000  0    0.0000   0.0000  0
11   0.8788   5.1000  2    0.0000   0.0000  0    0.0000   0.0000  0
12   1.2863   8.0000  2    0.0000   0.0000  0    0.0000   0.0000  0

POINTS ON THE PLUG
14   0.0000   8.0000
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS:
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
P
```

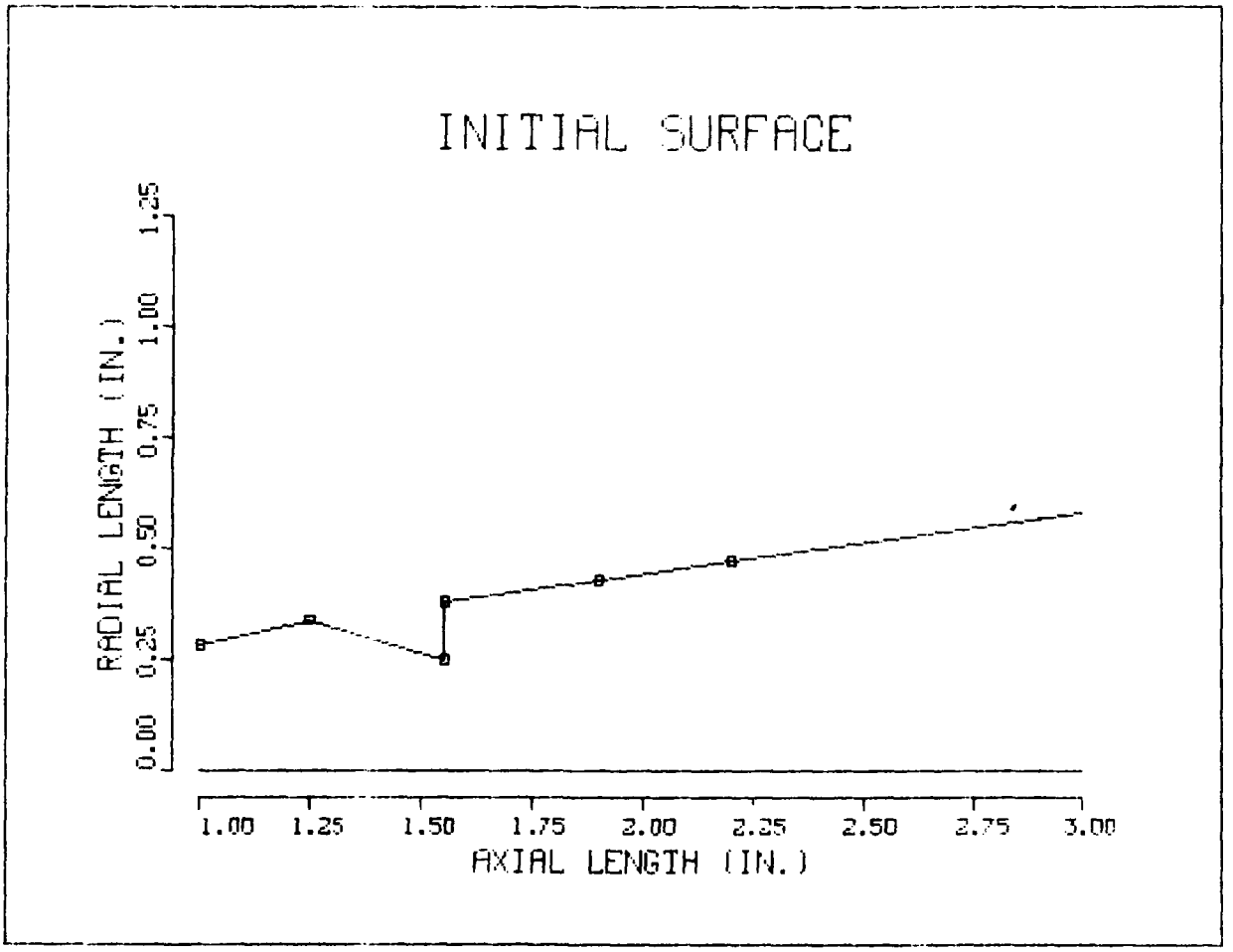


```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
C RSP 8 0.25

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
P
```



```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H =>HELP

MODIFY:
1 ALL 8
ENTER VALUES FOR RSP, ZSP, AND NB1 AT POINT  9
0.3798 1.55 1
ENTER VALUES FOR RSP, ZSP, AND NB1 AT POINT 10
0

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
S
CONTROL VARIABLES;  ISS = 0   0 => TRANSIENT CONDUCTION
                              1 => STEADY STATE COND.
                              2 => BOUNDARY LAYER
                    INOPT = 1   0 => ASCC77 INTERFACE FORMAT
                              1 => ASCC80 INTERFACE FORMAT
INTEGER VARIABLES:   KLF =15   NO. OF POINTS INCLUDING PLUG
                      NS =-13  NO. OF SURFACE POINTS
                     NPN = 0   NO. OF POINTS ON NOSETIP
                     MAT = 0   MATERIAL NUMBER
REAL *VARIABLES:  RNI = 0.06 INITIAL NOSE RADIUS
                 THETA = 0.00 INITIAL CONE HALF ANGLE
                  ZMAX = 0.00 MAX. VEHICLE LENGTH
                  STRD =200.0 MAX. TEMPERATURE RISE
                    TS = 585. INITIAL SURFACE TEMP.
GENERALIZED GEOMETRY WITH GENERALIZED INTERFACE FORMAT

SURFACE POINTS:

N     RSP       ZSP     NB1   RI1       ZI1     NB2   RI2       ZI2     NB3
 1    0.0000    0.0000   1    0.0000    0.0000   0    0.0000    0.0000   0
 2    0.0605    0.0010   1    0.0000    0.0000   0    0.0000    0.0000   0
 3    0.1050    0.2000   1    0.0000    0.0000   0    0.0000    0.0000   0
 4    0.1603    0.4500   1    0.0000    0.0000   0    0.0000    0.0000   0
 5    0.2157    0.7000   1    0.0000    0.0000   0    0.0000    0.0000   0
 6    0.2822    1.0000   1    0.0000    0.0000   0    0.0000    0.0000   0
 7    0.3375    1.2490   1    0.0000    0.0000   0    0.0000    0.0000   0
 8    0.2500    1.5500   1    0.0000    0.0000   0    0.0000    0.0000   0
 9    0.3798    1.5500   1    0.0000    0.0000   0    0.0000    0.0000   0
10    0.4290    1.9000   2    0.0000    0.0000   0    0.0000    0.0000   0
11    0.4712    2.2000   2    0.0000    0.0000   0    0.0000    0.0000   0
12    0.8788    5.1000   2    0.0000    0.0000   0    0.0000    0.0000   0
13    1.2863    8.0000   2    0.0000    0.0000   0    0.0000    0.0000   0

POINTS ON THE PLUG
15    0.0000    8.0000
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
P
```



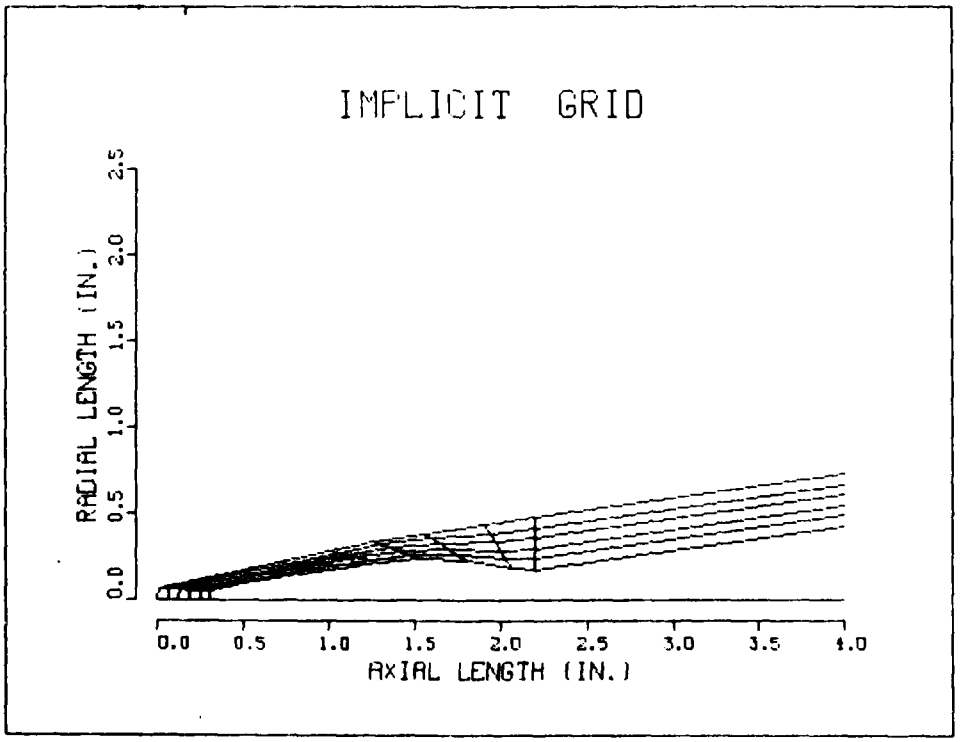
```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
D ALL 8 8

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
S
CONTROL VARIABLES:  ISS = 0   0 => TRANSIENT CONDUCTION
                              1 => STEADY STATE COND.
                              2 => BOUNDARY LAYER
                    INOPT = 1   0 => ASCC77 INTERFACE FORMAT
                              1 => ASCC80 INTERFACE FORMAT
INTEGER VARIABLES:  KLF =14   NO. OF POINTS INCLUDING PLUG
                     NS =-12  NO. OF SURFACE POINTS
                    NPN = 0   NO. OF POINTS ON NOSETIP
                    MAT = 0   MATERIAL NUMBER
REAL VARIABLES:  RNI = 0.06 INITIAL NOSE RADIUS
                THETA = 0.00 INITIAL CONE HALF ANGLE
                 ZMAX = 0.00 MAX. VEHICLE LENGTH
                 STRD = 200.0 MAX. TEMPERATURE RISE
                   TS = 585. INITIAL SURFACE TEMP.
GENERALIZED GEOMETRY WITH GENERALIZED INTERFACE FORMAT

SURFACE POINTS:

N    RSP      ZSP    NB1   RI1      ZI1    NB2   RI2      ZI2    NB3
 1   0.0000   0.0000  1    0.0000   0.0000  0    0.0000   0.0000  0
 2   0.0605   0.0010  1    0.0000   0.0000  0    0.0000   0.0000  0
 3   0.1050   0.2000  1    0.0000   0.0000  0    0.0000   0.0000  0
 4   0.1603   0.4500  1    0.0000   0.0000  0    0.0000   0.0000  0
 5   0.2157   0.7000  1    0.0000   0.0000  0    0.0000   0.0000  0
 6   0.2822   1.0000  1    0.0000   0.0000  0    0.0000   0.0000  0
 7   0.3375   1.2490  1    0.0000   0.0000  0    0.0000   0.0000  0
 8   0.3798   1.5500  1    0.0000   0.0000  0    0.0000   0.0000  0
 9   0.4290   1.9000  2    0.0000   0.0000  0    0.0000   0.0000  0
10   0.4712   2.2000  2    0.0000   0.0000  0    0.0000   0.0000  0
11   0.8788   5.1000  2    0.0000   0.0000  0    0.0000   0.0000  0
12   1.2863   8.0000  2    0.0000   0.0000  0    0.0000   0.0000  0

POINTS ON THE PLUG
14   0.0000   8.0000
```

```
     PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
              S => SHOW          P => PLOT          R => RETURN
              C => CHANGE        I => INSERT        D => DELETE
              H => HELP

MODIFY:
R

              PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
           PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
           MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
           GENERAL COMMANDS:   HELP  SAVE  NOPR  PRMT  HALT

COMMAND
ZOOM
CURRENT WINDOW COORDINATES ARE:
ZLEFT= 1.00 ZRITE= 3.00 RBOT= 0.00 RTOP= 1.00

ENTER NEW COORDINATES
0.0 4.0 0.0 1.0
```

#### 2.4.2.3 Modifying the Implicit Grid

In subsection 2.4.2.1, the plot of the implicit grid revealed a serious problem with the grid layout. This grid would be very unsuitable for BRLASCC's conduction calculation. It was modified at this point in the terminal session using MIMP. A listing of the important variables showed that a uniform grid was used. The variables DEL(I) I = 1, NS were changed to a nonuniform grid thickness, in order to make the grid appear uniform along the body. A uniform spacing along the rays was maintained by not defining DELN(3), and setting DELN(2) = 0.2. Notice that DELN(1) = 0. This variable is not used by BRLASCC OR BRLINPLOT. The DELN array starts at Index = 2 and ends at Index = LL.

```
          PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
        PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
        MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
        GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
MIMP

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
S
 VARIABLES:  NS =-12   NO. OF SURFACE POINTS
             LL =  6   NO. OF IN-DEPTH NODLETS
       OX =  2.20   ORIGIN OF RAYS (FROM NOSETIP)
UNIFORM IMPLICIT GRID: DEL  = 0.30000     GRID THICKNESS
                       DELN = 0.20000     NODLET THICKNESS

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
P
```

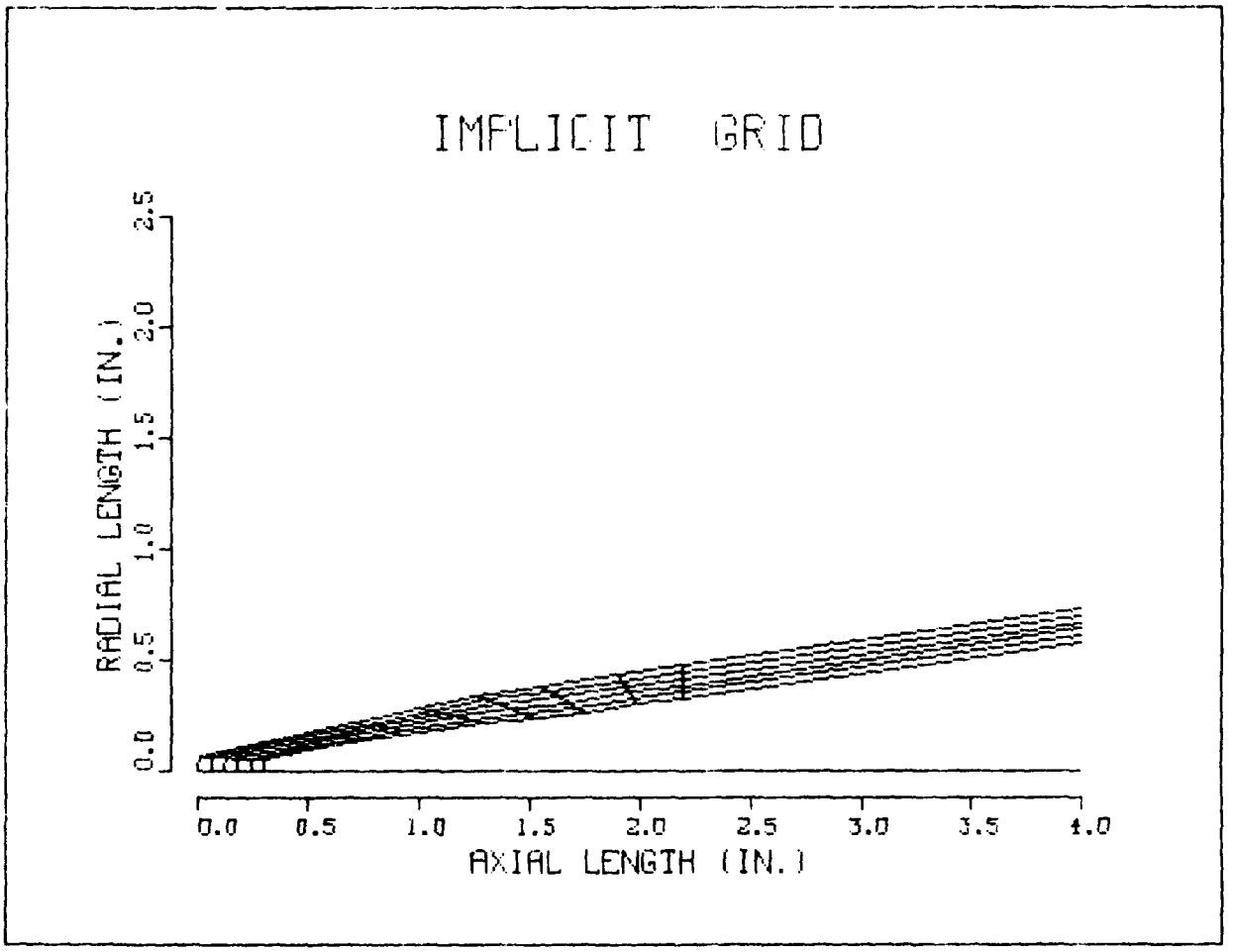


```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 2 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 3 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 4 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 5 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 6 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 7 .3
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 8 .25

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 9 .16

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 10 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 11 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DEL 12 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
S
VARIABLES:  NS =-12    NO. OF SURFACE POINTS
            LL =  6    NO. OF IN-DEPTH NODLETS
       OX =  2.20    ORIGIN OF RAYS (FROM NOSETIP)
```

```
IMPLICIT GRID THICKNESSES AND NODLET DISTRIBUTION:

    N     DEL          L    DELN
    1 0.30000         1 0.00000E+00
    2 0.30000
    3 0.30000
    4 0.30000
    5 0.30000
    6 0.30000
    7 0.30000
    8 0.25000
    9 0.16000
   10 0.15000
   11 0.15000
   12 0.15000

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C DELN 2 .2

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
S
VARIABLES:  NS =-12   NO. OF SURFACE POINTS
            LL =  6   NO. OF IN-DEPTH NODLETS
       OX =  2.20   ORIGIN OF RAYS (FROM NOSETIP)
IMPLICIT GRID THICKNESSES AND NODLET DISTRIBUTION:

    N     DEL          L     DELN
    1 0.30000         1 0.00000E+00
    2 0.30000
    3 0.30000
    4 0.30000
    5 0.30000
    6 0.30000
    7 0.30000
    8 0.25000
    9 0.16000
   10 0.15000
   11 0.15000
   12 0.15000
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
P
```




```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P = > PLOT         R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
R
```

2.4.2.4 Modifying the Explicit Grid

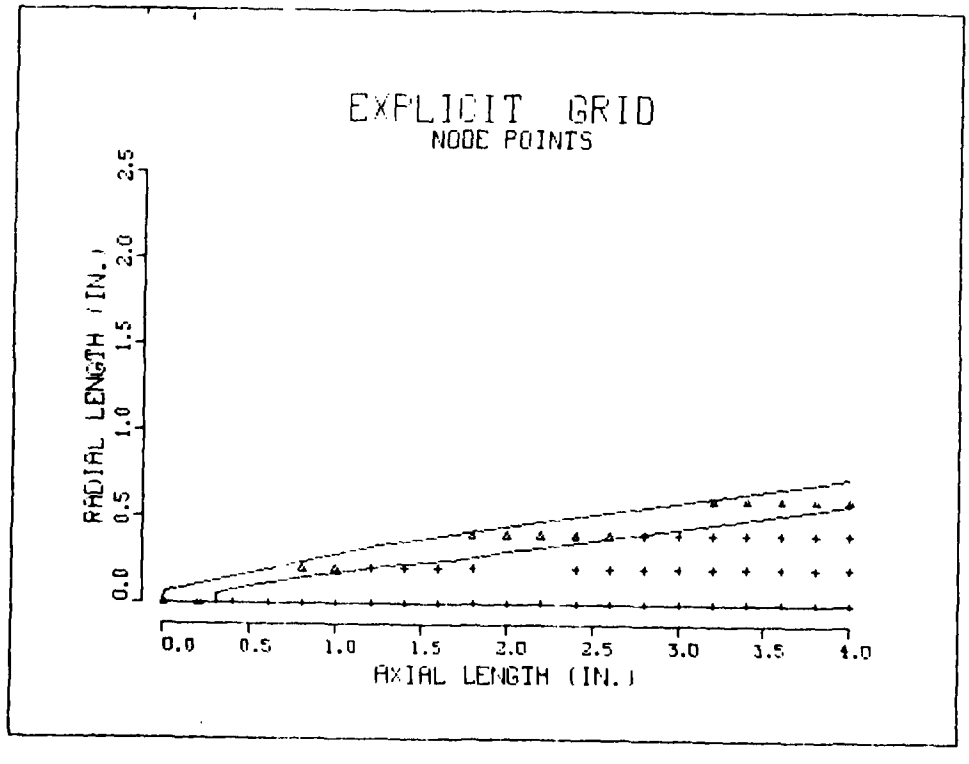
Using PEXP, the explicit grid was modified by the user. The user thought that the uniform spacing of XDIF(2) = 0.2 was too large so the grid size was reduced. The following hints are useful when modifying the explicit grid.

- If a uniform grid is desired, only XDIF(2) needs to be changed. The programs know to use uniform spacing if XDIF(3) = 0.
- If the user wants to change to a nonuniform grid, the best way is to reduce the number of grid points IL and JL, and then use the Insert method. If Insert is not used, then each and every grid point must be Changed which is more tedious for the user. (Both methods are illustrated in this subsection). As you insert values, the IL and JL counters will be updated.
- The user should make sure that there is a good overlap between the implicit and explicit grid system so that adequate boundary conditions will exist. The explicit grid points falling within the implicit grid are drawn as triangles.

Although many changes were made to the explicit grid, the user returned to a uniform grid with XDIF(2) = 0.15

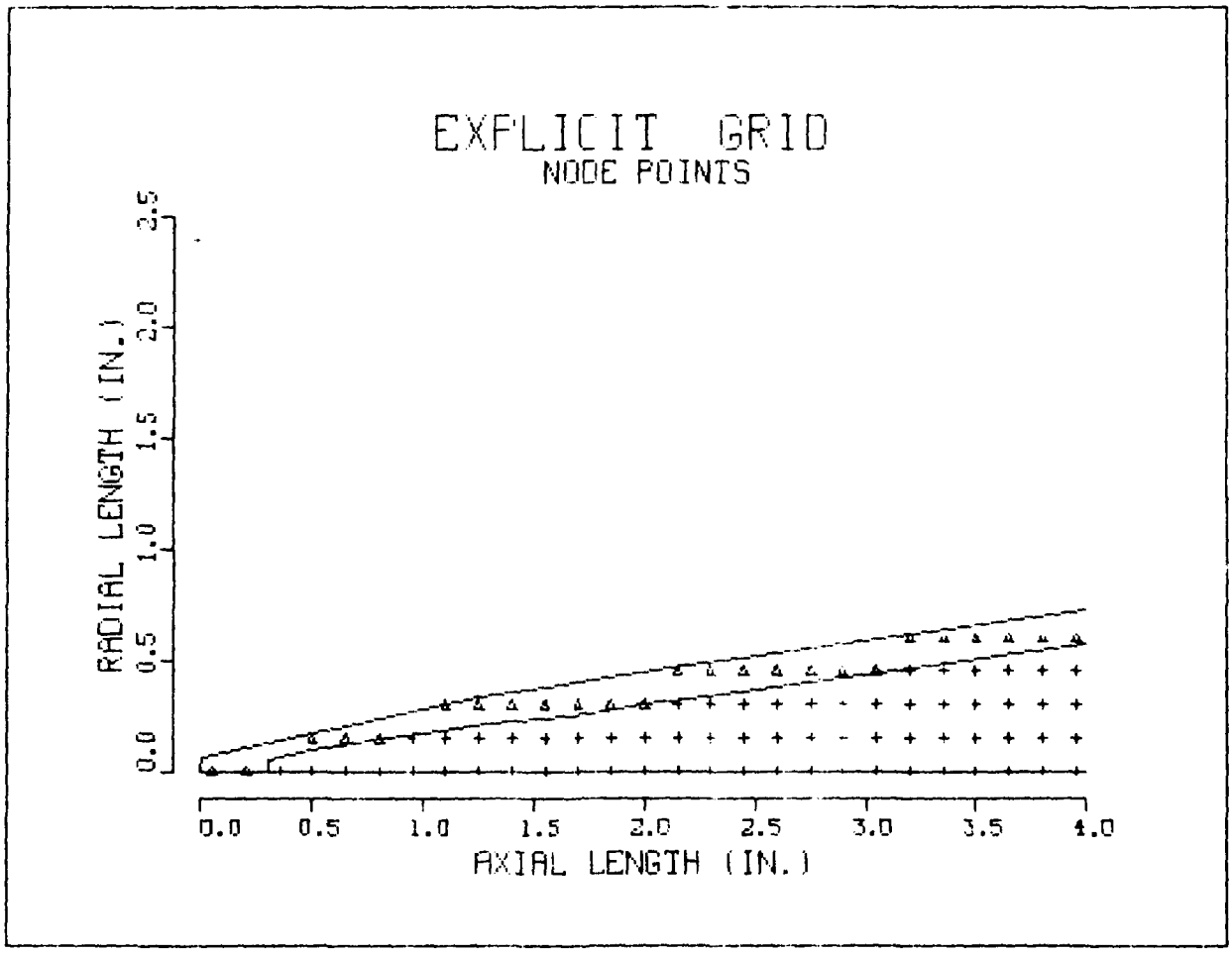
This was easily accomplished by setting XDIF(3) = 0 and XDIF(2) = 0.15. The other XDIF values and the YDIF values did not need to be changed back.

```
          PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
        PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
        MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
        GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
MEXP

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW           P => PLOT           R => RETURN
        C => CHANGE         I => INSERT         D => DELETE
        H => HELP

MODIFY:
S
INTEGER VARIABLES:  IL =44  NO. OF AXIAL VALUES
                    JL =10  NO. OF RADIAL VALUES
UNIFORM EXPLICIT GRID: XDIF = 0.20000     GRID STEP SIZE

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW           P => PLOT           R => RETURN
        C => CHANGE         I => INSERT         D => DELETE
        H => HELP

MODIFY:
P
```



```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
C IL 1 55

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
C JL 1 11

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
C XDIF 2 0.15
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
P
```




```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
R
```

```
            PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
          PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
          MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
          GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
ZOOM
CURRENT WINDOW COORDINATES ARE:
ZLEFT= 0.00 ZRITE= 4.00 RBOT= 0.00 RTOP= 1.00

ENTER NEW COORDINATES
0.0 8.0 0.0 2.7

            PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
          PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
          MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
          GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
MEXP

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
S
INTEGER VARIABLES:  IL =55  NO. OF AXIAL VALUES
                    JL =11  NO. OF RADIAL VALUES
UNIFORM EXPLICIT GRID: XDIF = 0.15000     GRID STEP SIZE

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
C YDIF 2 .1

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
S
INTEGER VARIABLES:  IL =55  NO. OF AXIAL VALUES
                    JL =11  NO. OF RADIAL VALUES
UNIFORM EXPLICIT GRID: XDIF = 0.15000     GRID STEP SIZE
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C XDIF 3 .1


PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
S
INTEGER VARIABLES:  IL =55  NO. OF AXIAL VALUES
                    JL =11  NO. OF RADIAL VALUES
EXPLICIT GRID STEP SIZES:

    I     XDIF         J    YDIF
    2 0.15000          2 0.10000
    3 0.10000          3 0.00000E+00
    4 0.00000E+00      4 0.00000E+00
    5 0.00000E+00      5 0.00000E+00
    6 0.00000E+00      6 0.00000E+00
    7 0.00000E+00      7 0.00000E+00
    8 0.00000E+00      8 0.00000E+00
    9 0.00000E+00      9 0.00000E+00
   10 0.00000E+00     10 0.00000E+00
   11 0.00000E+00     11 0.00000E+00
   12 0.00000E+00
   13 0.00000E+00
   14 0.00000E+00
   15 0.00000E+00
   16 0.00000E+00
   17 0.00000E+00
   18 0.00000E+00
   19 0.00000E+00
   20 0.00000E+00
   21 0.00000E+00
   22 0.00000E+00
   23 0.00000E+00
   24 0.00000E+00
   25 0.00000E+00
   26 0.00000E+00
   27 0.00000E+00
   28 0.00000E+00
   29 0.00000E+00
   30 0.00000E+00
   31 0.00000E+00
   32 0.00000E+00
```

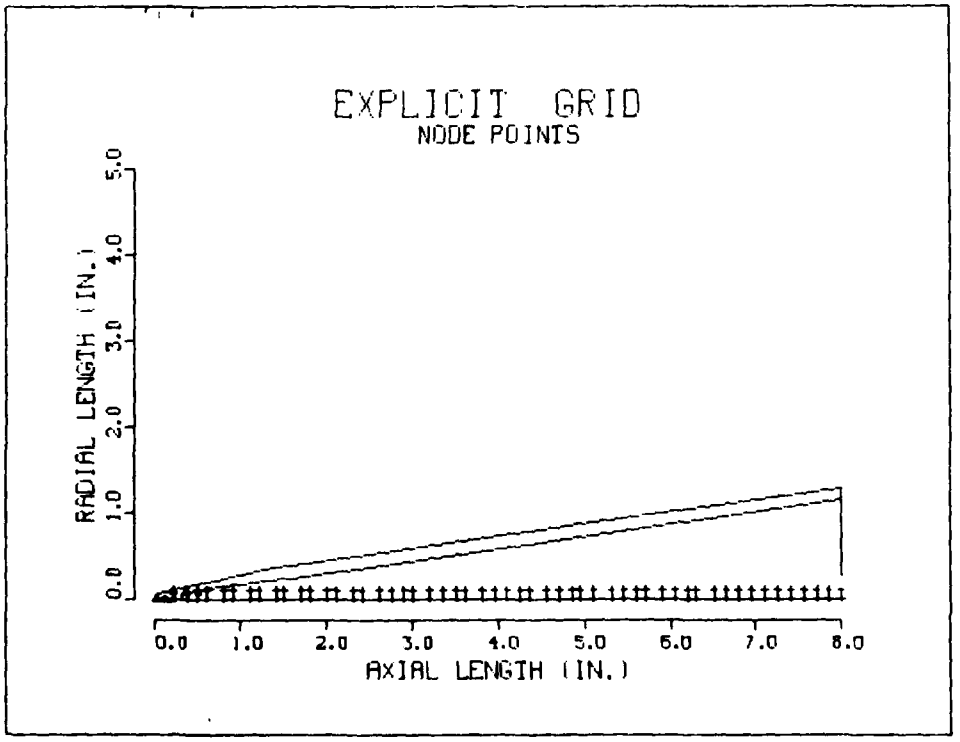
33 0.00000E+00
34 0.00000E+00
35 0.00000E+00
36 0.00000E+00
37 0.00000E+00
38 0.00000E+00
39 0.00000E+00
40 0.00000E+00
41 0.00000E+00
42 0.00000E+00
43 0.00000E+00
44 0.00000E+00
45 0.00000E+00
46 0.00000E+00
47 0.00000E+00
48 0.00000E+00
49 0.00000E+00
50 0.00000E+00
51 0.00000E+00
52 0.00000E+00
53 0.00000E+00
54 0.00000E+00
55 0.00000E+00

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C XDIF 3 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C XDIF 4 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C IL 1 4

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
S
INTEGER VARIABLES:  IL = 4  NO. OF AXIAL VALUES
                    JL =11  NO. OF RADIAL VALUES
EXPLICIT GRID STEP SIZES:

    I     XDIF         J    YDIF
    2 0.15000          2 0.10000
    3 0.15000          3 0.00000E+00
    4 0.15000          4 0.00000E+00
                       5 0.00000E+00
                       6 0.00000E+00
                       7 0.00000E+00
                       8 0.00000E+00
                       9 0.00000E+00
                      10 0.00000E+00
                      11 0.00000E+00

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C JL 1 2
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
S
INTEGER VARIABLES:  IL = 4  NO. OF AXIAL VALUES
                    JL = 2  NO. OF RADIAL VALUES
EXPLICIT GRID STEP SIZES:

    I     XDIF        J    YDIF
    2 0.15000         2 0.10000
    3 0.15000
    4 0.15000

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
I XDIF 4
ENTER VALUE  5
.15
ENTER VALUE  6
.15
ENTER VALUE  7
.15
ENTER VALUE  8
.15
ENTER VALUE  9
.15
ENTER VALUE 10
.15
ENTER VALUE 11
.15
ENTER VALUE 12
.2
ENTER VALUE 13
.1
ENTER VALUE 14
.15
ENTER VALUE 15
.15
ENTER VALUE 16
.2
ENTER VALUE 17
.1
ENTER VALUE 18
.15
ENTER VALUE 19
.15
```

```
ENTER VALUE 20
.2
ENTER VALUE 21
.15
ENTER VALUE 22
.1
ENTER VALUE 23
.15
ENTER VALUE 24
.15
ENTER VALUE 25
.2
ENTER VALUE 26
.1
ENTER VALUE 27
.15
ENTER VALUE 28
.15
ENTER VALUE 29
.15
ENTER VALUE 30
.2
ENTER VALUE 31
.1
ENTER VALUE 32
.15
ENTER VALUE 33
.15
ENTER VALUE 34
.2
ENTER VALUE 35
.1
ENTER VALUE 36
.15
ENTER VALUE 37
.15
ENTER VALUE 38
.2
ENTER VALUE 39
.1
ENTER VALUE 40
.2
ENTER VALUE 41
.1
ENTER VALUE 42
.2
ENTER VALUE 43
.1
ENTER VALUE 44
.2
ENTER VALUE 45
.1
ENTER VALUE 46
.2
```

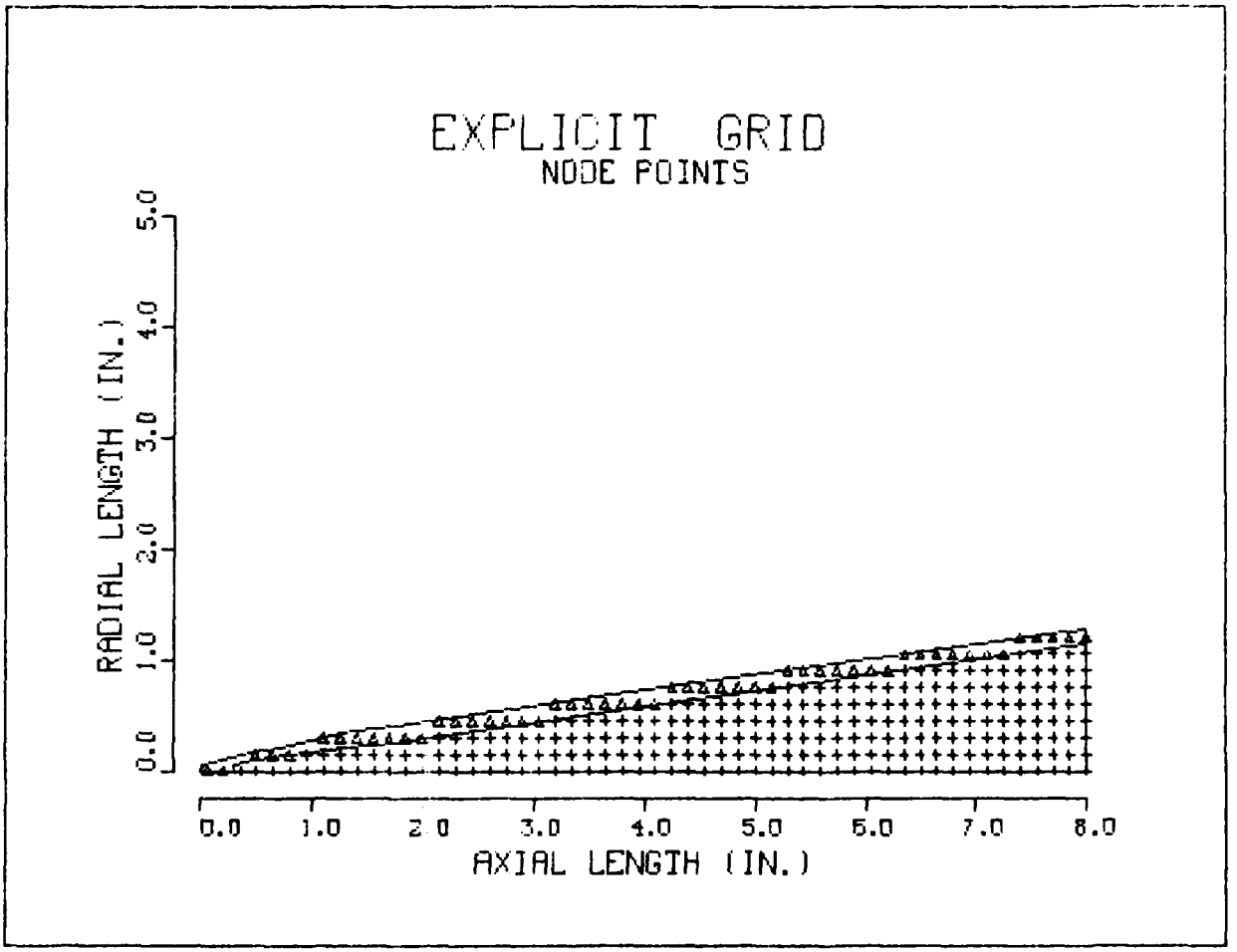
```
ENTER VALUE 47
.1
ENTER VALUE 48
.2
ENTER VALUE 49
.1
ENTER VALUE 50
.2
ENTER VALUE 51
.1
ENTER VALUE 52
.15
ENTER VALUE 53
.15
ENTER VALUE 54
.1
ENTER VALUE 55
.1
ENTER VALUE 56
.1
ENTER VALUE 57
Q

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
P
```



```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
S
INTEGER VARIABLES:  IL =56  NO. OF AXIAL VALUES
                    JL = 2  NO. OF RADIAL VALUES
EXPLICIT GRID STEP SIZES:

    I     XDIF        J    YDIF
    2 0.15000         2 0.10000
    3 0.15000
    4 0.15000
    5 0.15000
    6 0.15000
    7 0.15000
    8 0.15000
    9 0.15000
   10 0.15000
   11 0.15000
   12 0.20000
   13 0.10000
   14 0.15000
   15 0.15000
   16 0.20000
   17 0.10000
   18 0.15000
   19 0.15000
   20 0.20000
   21 0.15000
   22 0.10000
   23 0.15000
   24 0.15000
   25 0.20000
   26 0.10000
   27 0.15000
   28 0.15000
   29 0.15000
   30 0.20000
   31 0.10000
   32 0.15000
   33 0.15000
   34 0.20000
   35 0.10000
   36 0.15000
   37 0.15000
   38 0.20000
   39 0.10000
   40 0.20000
   41 0.10000
```

```
   42 0.20000
   43 0.10000
   44 0.20000
   45 0.10000
   46 0.20000
   47 0.10000
   48 0.20000
   49 0.10000
   50 0.10000
   51 0.10000
   52 0.15000
   53 0.15000
   54 0.10000
   55 0.10000
   56 0.10000

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C IL 1 55

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C JL 1 11

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
C XDIF 3 0.0

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S => SHOW          P => PLOT          R => RETURN
         C => CHANGE        I => INSERT        D => DELETE
         H => HELP

MODIFY:
S
INTEGER VARIABLES:  IL =55  NO. OF AXIAL VALUES
                    JL =11  NO. OF RADIAL VALUES
UNIFORM EXPLICIT GRID: XDIF = 0.15000     GRID STEP SIZE
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

MODIFY:
P
```




```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S => SHOW          P => PLOT          R => RETURN
        C => CHANGE        I => INSERT        D => DELETE
        H => HELP

Modify:
R
```

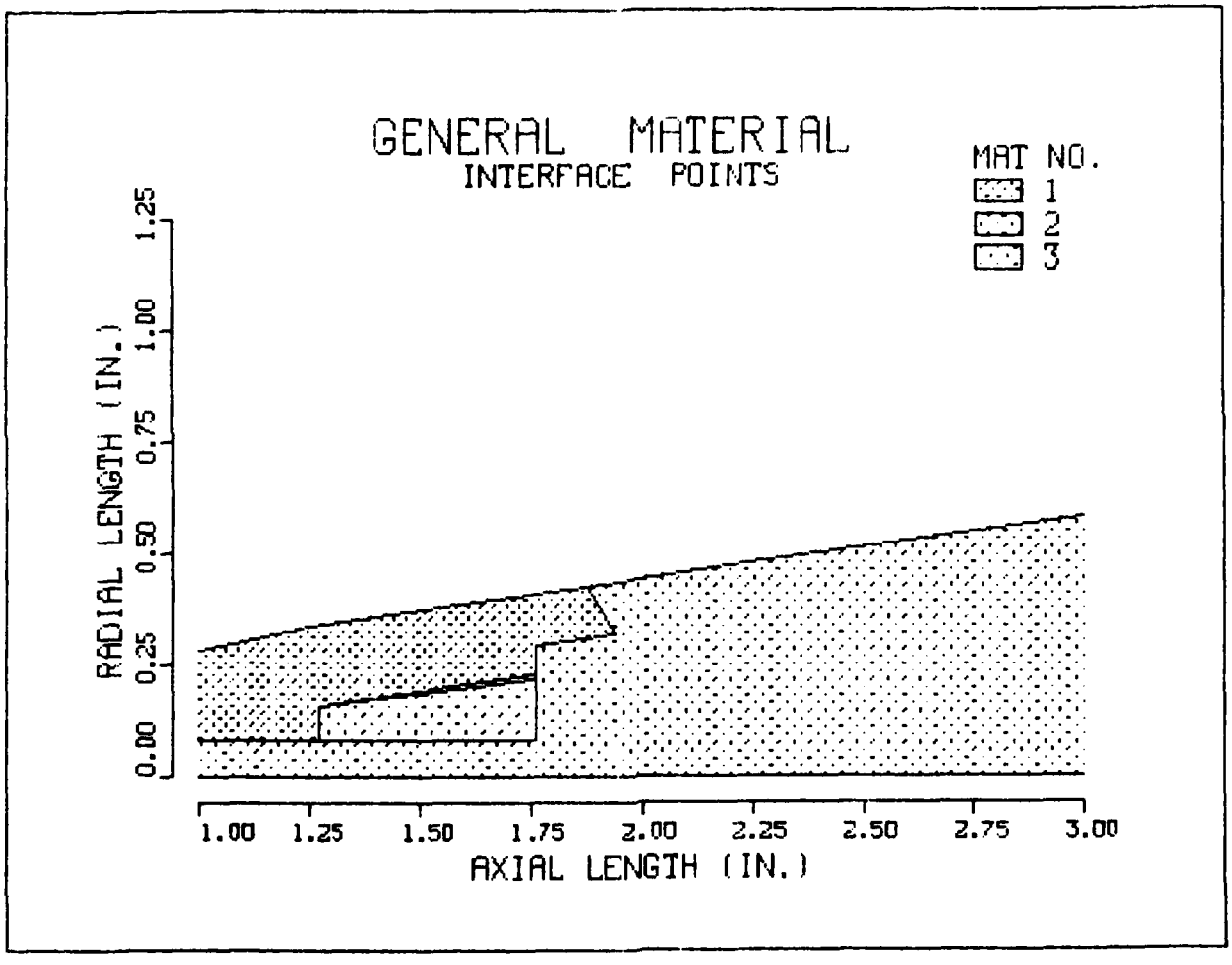
```
   PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL  ZOOM
MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT  HALT

COMMAND
ZOOM
CURRENT WINDOW COORDINATES ARE:
ZLEFT= 0.00 ZRITE= 8.00 RBOT= 0.00 RTOP= 2.70

ENTER NEW COORDINATES
1.0 3.0
0.0 0.5
```

### 2.4.2.5 Modifying the General Interface Locations

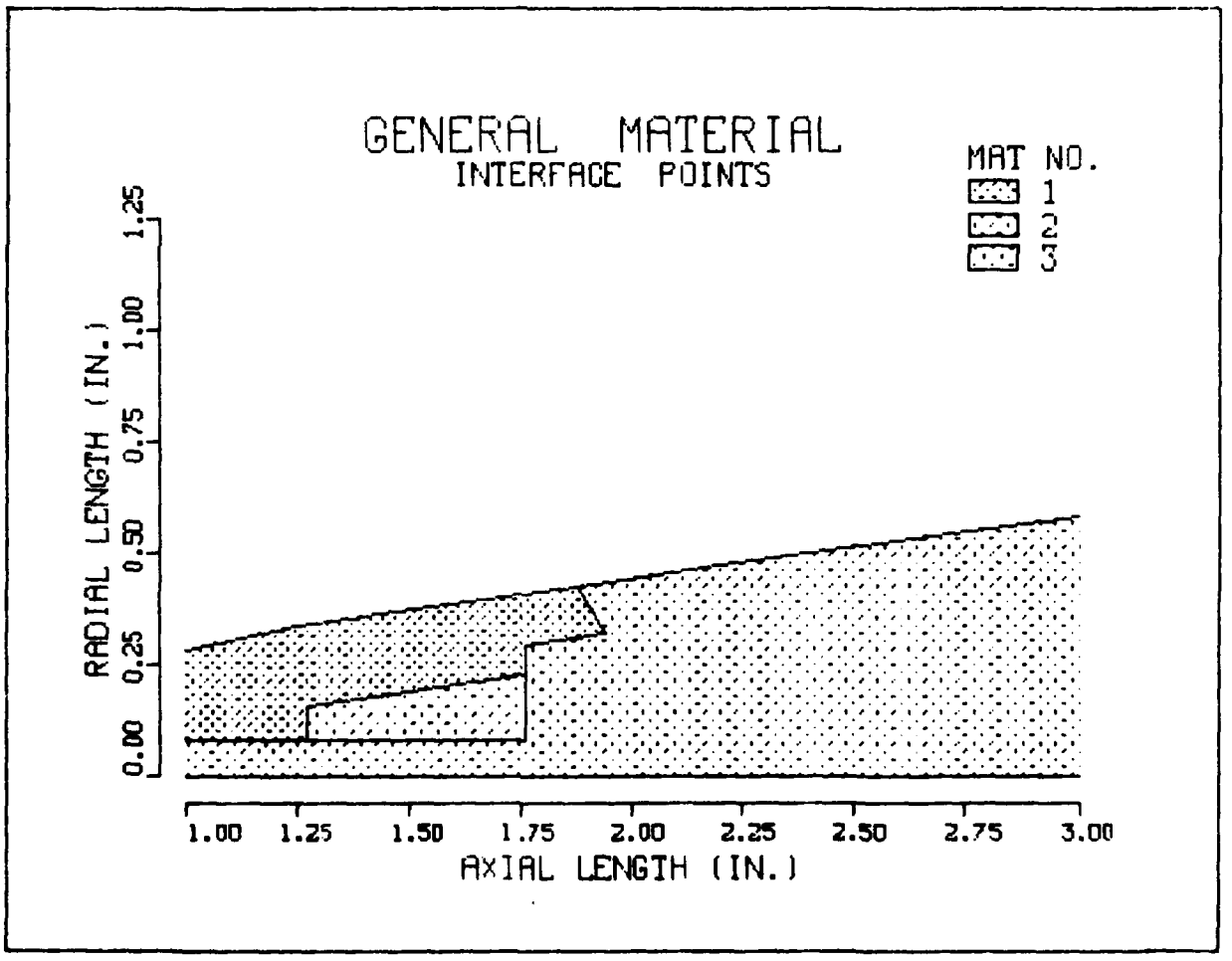
In subsection 2.4.2.1, the plot of the interface locations using PINT showed a small discrepancy in the interface definitions. In this section, the small gap between materials 1 and 3 was corrected. It was found that the radii of points 12 and 31 did not match, therefore point 31 was Changed and the new interfaces were Plotted. The user then completed the session by using SAVE to create a new geometry file with all corrections included.

```
 PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL   ZOOM
MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT   HALT

COMMAND
MINT

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S =< SHOW          P =< PLOT          R =< RETURN
         C =< CHANGE        I =< INSERT        D =< DELETE
         H =< HELP


MODIFY:
S
VARIABLES:    NIF= 33  NO. OF INTERFACE POINTS

INTERFACE LOCATIONS:

    N   RIS       ZIS       NBS
    1   0.0000    0.0000      1
    2   0.0605    0.0010      1
    3   0.1050    0.2000      1
    4   0.1603    0.4500      1
    5   0.2157    0.7000      1
    6   0.2822    1.0000      1
    7   0.3375    1.2490      1
    8   0.3798    1.5500      1
    9   0.4250    1.8750      1
   10   0.3200    1.9400      1
   11   0.2910    1.7600      1
   12   0.2260    1.7600      1
   13   0.1571    1.2680      1
   14   0.0775    1.2680      1
   15   0.0775    0.8600      1
   16   0.0000    0.8600      1
   17   0.0000    0.0000      1
   18   0.0000    0.8600      2
   19   0.0775    0.8600      2
   20   0.0775    1.7600      2
   21   0.2910    1.7600      2
   22   0.3200    1.9400      2
   23   0.4250    1.8750      2
   24   0.4712    2.2000      2
   25   0.8788    5.1000      2
   26   1.2863    8.0000      2
   27   0.0000    8.0000      2
   28   0.0000    0.8600      2
   29   0.0775    1.2680      3
   30   0.1571    1.2680      3
   31   0.2157    1.7600      3
   32   0.0775    1.7600      3
   33   0.0775    1.2680      3
```

```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S =< SHOW          P =< PLOT          R =< RETURN
        C =< CHANGE        I =< INSERT        D =< DELETE
        H =< HELP

MODIFY:
P
```

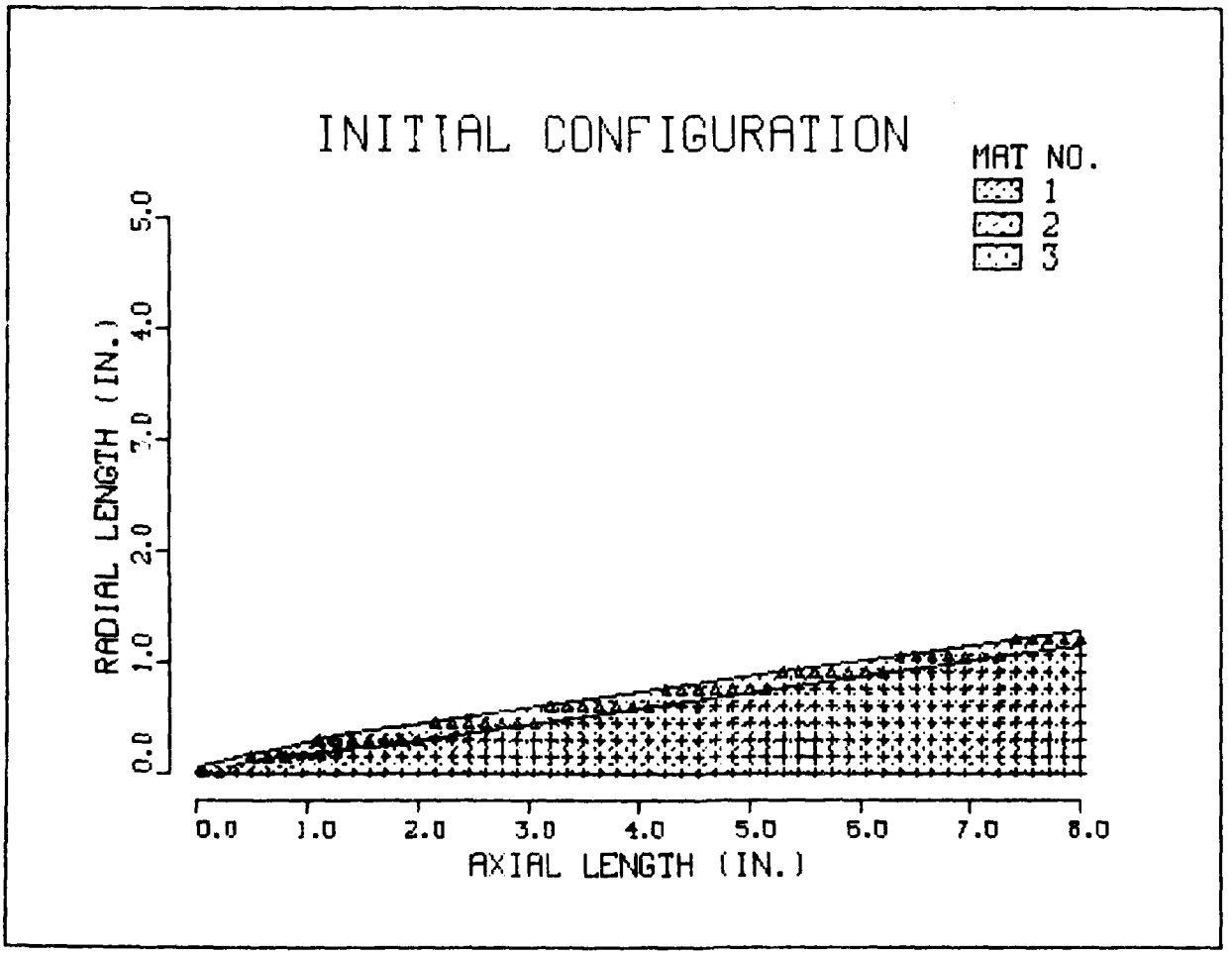


```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S =< SHOW          P =< PLOT          R =< RETURN
        C =< CHANGE        I =< INSERT        D =< DELETE
        H =< HELP

MODIFY:
C RIS 31  .2260

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
        S =< SHOW          P =< PLOT          R =< RETURN
        C =< CHANGE        I =< INSERT        D =< DELETE
        H =< HELP

MODIFY:
P
```



```
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS
         S =< SHOW          P =< PLOT          R =< RETURN
         C =< CHANGE        I =< INSERT        D =< DELETE
         H =< HELP

MODIFY:
R

              PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
             PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL   ZOOM
             MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
             GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT   HALT

COMMAND
NOPR
COMMAND
ZOOM
CURRENT WINDOW COORDINATES ARE:
ZLEFT= 1.00 ZRITE= 3.00 RBOT= 0.00 RTOP= 0.50

ENTER NEW COORDINATES
0.0 8.0 0.0 2.7
COMMAND
PRMT

              PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
             PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL   ZOOM
             MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
             GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT   HALT

COMMAND
SAVE
```

```
 PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL   ZOOM
MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT   HALT

COMMAND
PALL
```




```
 PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:
PLOT COMMANDS:      PSUR  PIMP  PEXP  PINT  PALL   ZOOM
MODIFY COMMANDS:    MSUR  MIMP  MEXP  MINT
GENERAL COMMANDS:   HELP  SAVE  UPDT  NOPR  PRMT   HALT

COMMAND
HALT
END OF DISSPLA 9.0 -- 27308 VECTORS GENERATED IN 15 PLOT FRAMES.
    PROPRIETARY SOFTWARE PRODUCT OF ISSCO, SAN DIEGO, CA.
8295 VIRTUAL STORAGE REFERENCES; 4 READS; 0 WRITES.
FORTRAN STOP
```

## 2.4.3 New BRLASCC Table 3

```
$ EDT NEWGEOM.PCH

03      BRL FLIGHT CASE (YUMA  TS=125 DEG-F, TO=60 DEG-F)
  -12    0    0
   0.60000E-01 0.00000E+00 P.00000E+00 2.2000       585.00       200.00
   0.00000 0.00000 1
   0.00100 0.06050 1
   0.20000 0.10500 1
   0.45000 0.16030 1
   0.70000 1.21570 1
   1.00000 0.28220 1
   1.24900 0.33750 1
   1.55000 0.37980 1
   1.90000 0.42900 2
   2.20000 0.47120 2
   5.10000 0.87880 2
   8.00000 1.28630 2
   33
   0.00000 0.00000 1
   0.00100 0.06050 1
   0.20000 0.10500 1
   0.45000 0.16030 1
   0.70000 1.21570 1
   1.00000 0.28220 1
   1.24900 0.33750 1
   1.55000 0.37980 1
   1.87500 0.42500 1
   1.94000 0.32000 1
   1.76000 0.29100 1
   1.76000 0.22600 1
   1.26800 0.15710 1
   1.26800 0.07750 1
   0.86000 0.07750 1
   0.86000 0.00000 1
   0.00000 0.00000 1
   0.86000 0.00000 2
   0.86000 0.07750 2
   1.76000 0.07750 2
   1.76000 0.29100 2
   1.94000 0.32000 2
   1.87500 0.42500 2
   2.20000 0.47120 2
   5.10000 0.87880 2
   8.00000 1.28630 2
   8.00000 0.00000 2
   0.86000 0.00000 2
   1.26800 0.07750 3
   1.26800 0.15710 3
   1.76000 0.22600 3
   1.76000 0.07750 3
   1.26800 0.07750 3
1   8.0000      0.00000E+00
    6   12
   0.20000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
   0.30000E+00 0.30000E+00 0.30000E+00 0.30000E+00 0.30000E+00 0.30000E+00
   0.30000E+00 0.25000E+00 0.16000E+00 0.15000E+00 0.15000E+00 0.15000E+00
   55   11
   0.15000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
Command:  EXIT
```

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